

# GOVERNMENT AND TECHNOLOGY

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WILLIAM BEARD



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# GOVERNMENT AND TECHNOLOGY

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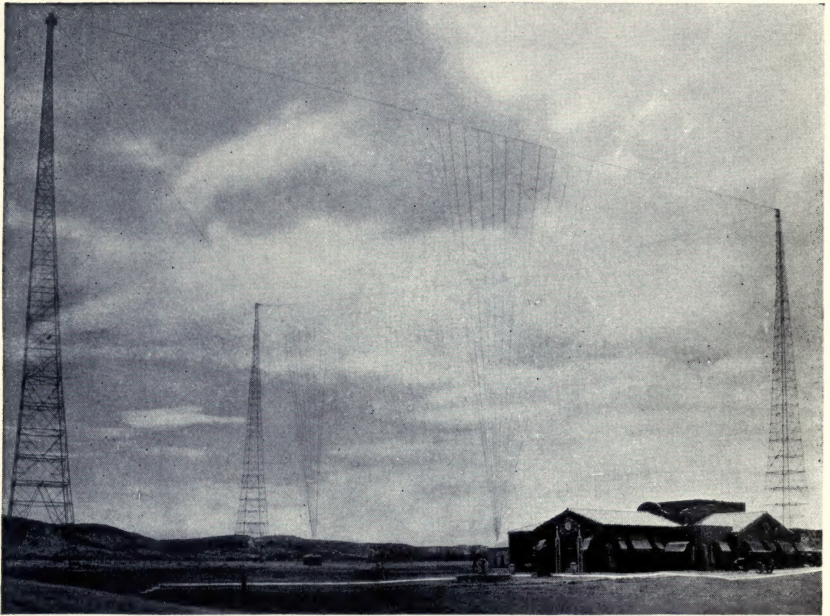
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### ESCAPING AMERICAN CENSORS

Radio station XER, Mexico. By erecting XER, an American, who was refused a broadcast license renewal in the United States, continued to reach American listeners with programs in English. XER was once the most powerful regular broadcast plant on the continent, and was connected by wire with Kansas (*see p. 490*).



# GOVERNMENT AND TECHNOLOGY

An Outline for Engineering Students

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BY

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1934

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## PREFACE

Engineering colleges, as a rule, offer minimum instruction in the study of government. Frequently the course is omitted entirely, or in the event it is given, the subject is often presented from the point of view of political science. In the former case, engineers begin their careers without any systematic knowledge of the government to which they owe obligations as citizens and by which they may be employed or regulated directly or indirectly in their construction and operating activities. In the latter case, they acquire in connection with their study of government only a slight knowledge, if any at all, of the intricate and vital relations of engineering to government. Thus they are inadequately prepared to assume their responsibilities either as citizens or in their profession.

This volume represents an effort to supply a part at least of the new literature required to fill this gap in engineering education. It approaches the subject of government from the standpoint of technology. It lays emphasis on those aspects of government which particularly concern the engineer, referring students for the amplification of knowledge concerning government as law and politics to the numerous standard treatises by political scientists. My purpose has not been to furnish an encyclopaedia but a suggestive guide to a field as yet almost unexplored, with the hope that other students will develop phases of the subject in detail. Not until numerous special studies have been made respecting the relations of technology and government will it be possible to write anything approaching an ideal treatise on technology and government in general.

In the preparation of this volume I have incurred many debts. To the California Institute of Technology and to

Professor W. B. Munro in particular I am under obligation for the opportunity to work freely in a new field. A grant from the Carnegie Corporation to the Institute for the purchase of books and other materials has greatly facilitated my inquiries. It is proper also that I should pay tribute to my Alma Mater, the Massachusetts Institute of Technology, for a sound training in the science of engineering. Finally I am indebted to my father, Charles A. Beard, for reading the manuscript and for giving many helpful suggestions touching the form, spirit, and thought of the book. As authors are fond of saying, for the errors and shortcomings I alone am responsible. That is truth as well as pleasantry, in my case.

If by the method followed I succeed in interesting engineering students in the subject of government, in its relations to their profession and their activities, then the political scientists may be willing to overlook the scanty treatment accorded to some of their cherished themes—even perhaps to ponder a little on the bearing which the technological approach may have on their branch of learning called “political science.”

WILLIAM BEARD

SCHOOL OF THE HUMANITIES,  
CALIFORNIA INSTITUTE OF TECHNOLOGY,  
April, 1934



# TABLE OF CONTENTS

	PAGE
PREFACE . . . . .	v
CHAPTER	
I. CONTACTS OF TECHNOLOGY WITH GOVERNMENT .	1
II. POLITICAL BOUNDARIES AND JURISDICTIONS . .	18
III. POPULAR CONTROL IN A TECHNOLOGICAL SOCIETY .	63
IV. THE SEPARATION OF POWERS IN GOVERNMENT . .	96
V. LEGISLATIVE PROCESSES . . . . .	110
VI. JUDICIAL PROCESSES OF LAW ENFORCEMENT . .	164
VII. EXECUTIVE PROCESSES OF LAW ENFORCEMENT— ADMINISTRATION . . . . .	211
VIII. MANAGEMENT OF GOVERNMENT EXPENDITURES .	258
IX. REVENUES, DEBTS, AND CURRENCY . . . . .	291
X. WAR AS AN INSTRUMENT OF POLITICAL POLICY . .	320
XI. REVENUE-PRODUCING ENTERPRISES OF GOVERNMENT	356
XII. FREE SERVICES OF GOVERNMENTS . . . . .	387
XIII. THE REGULATION OF PUBLIC UTILITIES . . . .	419
XIV. PATENTS, COPYRIGHTS, AND TRADE-MARKS . . .	445
XV. HEALTH AND SAFETY REGULATIONS . . . . .	463
XVI. PERSONAL LIBERTY . . . . .	485
XVII. PLANNING—CITY AND REGIONAL . . . . .	502
XVIII. NATION PLANNING—THE INTEGRATION OF ECONOMY	521
 BIBLIOGRAPHY . . . . .	555
 INDEX . . . . .	589





# GOVERNMENT AND TECHNOLOGY

## CHAPTER I

### CONTACTS OF TECHNOLOGY WITH GOVERNMENT

#### HOW GOVERNMENT AFFECTS THE ENGINEER

**Subsidies.** Eager throngs fixed their eyes on bulletin boards. Wires were cleared of all ordinary traffic. Far out on the Western plains two high-stacked locomotives rolled towards each other until their cowcatchers were only a few yards apart. Between them a gang of workmen was busy placing ties and rails in position. Finally all was ready. With heavy blows a last, golden spike was driven home. The word "DONE" was immediately flashed by telegraph from city to city. Two hundred and twenty guns boomed a salute in San Francisco. A ball signal dropped at Washington. Bells chimed in New York. Milling crowds cheered and cheered. Thus, on the tenth of May, 1869, the first trans-continental railroad across American soil was brought to completion—a great engineering feat made possible by lavish grants of land and money from the Federal treasury.

Similar acts of benevolence served to promote other lines. All told, between 1850 and 1923, Federal and state authorities donated to the railroads of the country a total of at least 202,000 square miles of land, equivalent to more than the area of the state of California! Such tracts often proved a great boon; the Northern Pacific Railway alone is reported to have sold off its surplus acreage for \$136,000,000, an amount almost double the initial cost of the road.

In engineering operations on the seas as well as on land, the results of governmental generosity are visible. Federal financial assistance to shipping, in the form of mail payments, amounted to \$14,355,000 for the fiscal year ended June 30, 1930. With the help of an air mail subsidy of \$13,863,000 for the same period, scores of planes motored their way through the American skies. Many an engineer has owed his livelihood, even the very existence of his enterprise, to the stimulus of government subsidies.

**Free Government Services.** Supplementing their outright gifts of land or money to technological enterprises, American governments assist engineering undertakings by constructing and maintaining various free facilities. During the nineteenth century over a billion and a quarter dollars were spent by the United States War Department in river and harbor work. Yet, with the exception of the Panama Canal, now run on a toll basis, vessels are permitted to use all federally improved waterways without charge. Additional millions have gone into the establishment of a system of lighthouses, buoys, radio-beacons, and other "aids to navigation," rendering service without charge. The air line operator, too, is the recipient of government favors. During the five years ended June 30, 1931, Federal authorities spent over twenty million dollars in building and operating beacons, emergency landing fields, and the accompanying airway equipment; yet craft passing over the national routes were not assessed one cent for the privilege. A third party, the automotive trade, is under heavy obligations to government; for the phenomenal growth of the industry is due, in a large measure, to enormous public expenditures for good roads, in the days before the gasoline tax was invented as a means of making motor vehicles share the cost.

Governments place information, as well as actual equipment, at the service of engineers, substantially free of charge. Federal authorities furnish, at a nominal cost for printing, all kinds of scientific data collected at great expense. In-

cluded in this list are water flow records for American rivers, running back for many years; ocean tide and current figures; geological, topographical, soil, and coast survey maps; and experimental papers on aeronautical design, radio research, insect control, mining methods, and geological formations. State bodies swell the contributions to engineering knowledge. In short, governments assist technological enterprises with subsidies and free services amounting to millions upon millions of dollars a year.

**Regulatory Work.** Governments are more than benevolent organizations, helping needy technological enterprises. They are also stern regulators. One of the most fundamental tasks of the national authorities, in the latter field, is the management of the patent system. Up to 1931 some 1,800,000 patents had been issued; seven-eighths of our industrial activities are dependent directly or indirectly on these monopolistic grants. Public utilities, representing approximately a fifth of the productive wealth of the nation, form the center of a second large area of government regulation. The rates charged for water, gas, electricity, heat, and transit, the technical excellence of the service that must be rendered, even the basic right to engage in or quit the business, are all subject to political control. The design of dangerous apparatus and structures, too, calls for positive action on the part of government. Skyscrapers, automobiles, aircraft, steamships, railway equipment, and radio transmitters are inspected by Federal, state, or local officers to insure compliance with a complex body of laws. Frequently regulations covering details on a single type of equipment run into a book of from 100 to 250 pages in length.

**The Nature of the Recovery Program.** By a series of remarkable laws enacted in 1933, the Government of the United States undertook the regulation of all industries, including agriculture. It fixed a broad frame of government control and planning for industries and permitted them to enter into agreements or codes covering stabilization of pro-



duction, price and wage fixing, and fundamental industrial and trade practices, including collective bargaining with organized labor. It entered into "partnership" with these industries and allowed them to engage in activities designed to control and stabilize their enterprises—activities which had been hitherto forbidden by anti-trust laws. As the distinguished economist, Frank Albert Fetter, has said, these policies "not without reason are called revolutionary." And these policies affect all engineering activities and the engineering profession from beginning to end, from top to bottom.

**The Long-Time View of the Recovery Program.** These "revolutionary" policies, to be sure, are regarded as directed to an emergency and are expected, by some, to pass with the emergency. But a backward look will put engineers on their guard about assuming hastily that these policies will be wholly abandoned in the near future. The question of what to do with the "trusts," which are great combinations of technological enterprises, has long been before the country. Two alternatives have been presented for many years. One is to break up or dissolve the trusts by prohibitions and prosecutions. The other is to subject them to government control, more or less drastic. The former policy was tried between 1890 and 1933, under anti-trust acts of Congress. In spite of threats and prosecutions, combination and concentration in industry went on at an accelerating pace. In other words, depression or no depression, "trust busting" failed. Hence the other alternative, depression or no depression, was thrust upon the country. It was adopted during the depression, it is true, but if the depression passes, the second alternative will still remain the only apparent escape from the problem long debated and discussed. There is no reason for believing, therefore, that the great technological industries will be returned to the old order of so-called "independence," subject to prosecution and persecution. What their position will be cannot now be determined, but it is far from likely that the "partnership" between government

and industry can or will be broken. The relation in the future will probably be closer.

**Governments Operate Enterprises.** Not content with the promotion and regulation of private industries, the several units of American government have themselves embarked on commercial ventures in the field of technology. Utilities owned and operated by public agencies are common. In 1927 there were 2,198 municipal electric plants, with a combined capacity of 1,400,000 kilowatts, and a total valuation of over \$400,000,000. Municipal gas plants numbered 110 in 1923. Of the 250 American cities having a population in excess of 30,000 in 1927, 210 owned and operated their water-works. On August 1, 1930, there were 62 government toll bridges in operation, valued in excess of \$45,000,000, with a series of notable works still under construction. Outstanding among transportation systems are the government-owned street railways, the Panama Canal, the Alaska Railroad, the United States Shipping Board Bureau in the Department of Commerce, and the Inland Waterways Corporation. To the utilities must be appended a variety of other undertakings. Government irrigation projects, representing an investment of \$233,000,000, watered some 3,360,000 acres of land in 1920. On January 1, 1930, there were 453 completed municipal airports. Over 100,000,000 acres of forest lands are now in public hands. State printing plants, city ice and central heating plants, national arsenals and shipyards, and a host of others swell the total of government enterprises to impressive proportions. Government undertakings, besides making use of technologists on a large scale, are thus constant challenges to private concerns in the engineering field.

**Employment of Engineers in Public Service.** As promoters, regulators, and operators of engineering enterprises, Federal, state, and local governments in the United States must of necessity employ many different classes of technical experts. Opportunities for securing positions in research, civil, mechanical, electrical, chemical, and other engineering special-

ties in government service are therefore substantial. The national authorities alone employ skilled technologists of many grades and classes (see Chapter VII). In a survey made during 1914, the American Society of Civil Engineers discovered that approximately thirty per cent of its members were working for the nation, states, counties, and cities, in official posts.

**Supplies and Contracts.** Even when the engineer is not serving as a government agent, or acting under government regulations, as a producer of supplies he may still come in close contact with official bodies. The range of items purchased by the Federal Government, not to mention state and local units, is truly astonishing, comprising almost everything from dirigibles, freight cars, lighthouse lenses, and typewriters to aluminum paint, radio tubes, periscopes, electric drills, gyro-compasses, and steam dredges. When engaged in contracting, rather than in the sale of commodities and machines, the private engineer becomes involved in government operations through his interest in public works, such as channel dredging, highway building, the erection of offices, the digging of subways, and the pouring of concrete dams. In the aggregate, during recent years, approximately \$3,000,000,000 has been spent annually on public-works construction. In 1933 Congress made a special appropriation of \$3,400,000,000 to be expended by national and local units for public works, for the purpose of setting the whole productive system of the country in motion again and breaking the jam of the depression.

**Future of Public Works.** Whatever may happen to the other "emergency measures" of 1933, it seems fairly certain that the public-works section of the program will remain, as a kind of stabilizer to business, if nothing else. It had been conceived long before the panic of 1929 broke. Under President Harding at a conference on unemployment, sponsored and guided by the Secretary of Commerce, Herbert C. Hoover, emphasis had been laid upon the planned and

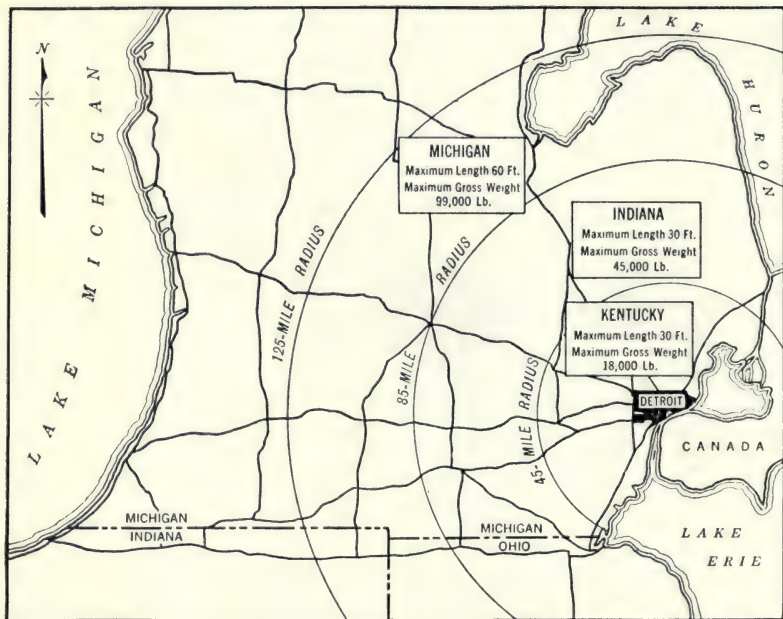




*Photograph by Brown Brothers*

### THE GOVERNMENT LETS PUBLIC-WORKS CONTRACTS

In 1931, the Federal Government awarded the contract for the construction of Hoover Dam (*see p. 371*) to Six Companies, Inc., for \$48,890,995. The photograph shows a portion of Boulder City, built to house the force connected with the project.



*Courtesy of the Journal of the Society of Automotive Engineers*

### GOVERNMENT REGULATIONS AFFECT ENGINEERING ECONOMY

The larger the trucking unit permitted under state law, the greater the distance over which milk can be hauled with profit. The circles on the above map indicate the areas tributary to Detroit that can be economically served under the size restrictions in force in three different states (see p. 40).

extensive use of public works to offset periodical declines in private industries. Later, at a conference of state governors, a plan, known as "the Hoover Plan," was adopted—a plan calling for the deliberate and intelligent use of public-works construction as a "stabilizer" of industrial processes. The emergency program of 1933 adopted this idea and applied it on a large scale. Since, in many fields, industry and transportation are already "overbuilt," with the rounding out of the American continent, many construction engineers have come to the conclusion that a considerable diversion of capital to non-profit making, non-competitive undertakings is absolutely necessary to keep ordinary industrial plants running at anything like capacity. At all events, emphasis on the public-works side of government activity will probably increase rather than diminish.

In view of such facts, engineers are clearly justified in the belief that their profession will have larger responsibilities than ever in relation to society and its agent—government. And, since the fundamental economic activities with which government is now concerned are all technological, there comes an increasing call to the profession for the kind of leadership which its rationality and constructive energies make indispensable to society and government. This seems like a crucial hour for engineering.

#### HOW TECHNOLOGY AFFECTS GOVERNMENT

**Engineers Appreciating Impacts of Their Art on Government.** So far we have taken a narrow and "practical" view of the engineering profession in its relations with government. There is another side of the shield, of wider and deeper significance. Government, in its several legal and geographical jurisdictions, is more than a group of authorities who subsidize engineering operations, furnish scientific data, buy supplies, employ experts, regulate utilities, make contracts for public works, and enact legislation affecting technological enterprises. Governments are agents of society, of which



engineers are a part—a society that is constantly and rapidly changing as technology alters ways of industry and living, revolutionizes transportation and communication, and accumulates scientific knowledge. If in the past the technician has been content to carry on his work with little or no thought about its influence on society and government, there are signs that he is beginning to widen his horizon, and to be concerned about the problems of society and government raised by the transformation of all industrial and governmental functions under the impacts of technology. Especially after the opening of the great economic depression in 1929, which sent thousands of skilled engineers and architects into the streets looking for employment along with day laborers, the technician was forced to see that as a specialist and a citizen he was involved in the fate of industry as a whole, of society at large, and of government as an agency of society.

Thus the complexities, burdens, and difficulties of government, long relegated by the engineering profession to the care of average citizens and politicians, assumed new aspects for technologists, inviting them to do more fundamental thinking about the work of their hands and the conditions in which they could carry on their operations. Thus the practical side of their professional relations with government, seen as private interest, was supplemented by considerations of governmental efficiency.

**Expansion of the Technical Functions of Government.** For example, engineers are beginning to see that it is customary for governments to assume one new technical duty after another without attempting correspondingly to improve their managerial efficiency. The past growth of public functions in a single municipality—Detroit, Michigan—reveals the general problem as under a microscope. In 1836 the city embarked on the building and maintenance of a water and sewerage system. The year 1850 saw the first street lighting. Organized fire fighting was inaugurated shortly after the Civil War, followed in 1873 by a police alarm

signal net. In the eighties problems of health were tackled: quarantines for contagious diseases were established, a chemical laboratory was built, milk inspection was started, and rubbish and garbage were collected. Shortly before the turn of the century, a fleet of fire boats was purchased, a bacteriological laboratory put in operation, and inspectors were appointed for the examination of plumbing, boilers, and electrical wiring. In 1902 the regulation of smoke was undertaken, followed in 1905 by street flushing. The development of the movie resulted in motion picture censorship as early as 1908. Growing traffic problems were responsible for the installation of traffic control in 1909. The skyscraper made imperative a program of elevator inspection in 1911. During the World War police auto patrols and the checking of refrigeration got under way. The year 1919 saw the beginnings of motor street-sweeping. In 1920 the city took over certain street railway lines. Increased police efficiency was secured in 1921 through radio control of patrol cars. City water was filtered in 1923, oil burners and explosives testing began in 1925 and 1926 respectively, and zoning plans were laid in 1929. The latter year also witnessed the building of a city airport.

Growing by steady accretion as technology has advanced, modern governments have lost their simple character. They have become masses of bureaus, offices, agencies, departments, and commissions engaged in discharging technical functions. Duplication of effort arises between units. Persons in quest of permission for given undertakings rush from desk to desk, driven frantic by red-tape. Lines of responsibility running from governor, President, or mayor to minor subordinates are clouded; strong central control vanishes. Complexity reaches the stalling point. Determined to find a way out of the situation, specialists have sought relief through experimental planning in public administration. They have organized research bodies to inquire into administrative methods and to introduce order and efficiency.

The result has been a series of wholesale overhauls of executive systems in cities and states and in 1933 at the national capital. Units performing similar tasks have been consolidated in departments, with clear-cut lines of authority from chief to messenger-boy. Commissions, weak on action but strong on argumentation, give place to single officers. And so the bureaucracy that grew so rapidly and once seemed impossible to manage is being remolded presumably into a workable structure.

Yet at the very moment when the functions of government which have been accumulated in the process of technological development are being organized with increasing skill, a still greater extension of functions is under way. Unemployment and stagnation in industry, springing in a large measure from the phenomenal developments in labor-saving devices, challenge society and government, throwing new responsibilities on the latter. By the National Industrial Recovery Act of 1933, as we have seen, all the great industries of the country, resting at bottom on technological processes, are brought under the organizing and regulating authority of the Federal Government. If this tendency continues, and the periodical character of industrial crises indicates that it will, then the contacts of technologists with government will become closer, and heavy drafts will be made upon their powers as thinkers, organizers, managers, directors, and producers. The strength of the human mind may well be taxed to the limit.

**Technology Cuts across Political Boundaries.** Just as each individual government has been transformed in its functional nature by the impacts of technology, so have the relations between governments been profoundly altered. Early in our history the several local, state, and national authorities followed their separate courses with little overlapping and conflict. Today the wide extent of engineering work calls for coöperative action on the part of scores of units which were formerly more or less isolated. Flood



control on the Mississippi River involves concerted effort on the part of the nation as well as of a cluster of states. The City of Chicago, by draining water from the Great Lakes to solve a sanitation problem, lowered harbor depths in seven states, drawing Canada into the dispute in the bargain. Twenty years of wrangling among seven Western states preceded a final agreement upon terms for building Hoover Dam with its attendant undertakings. Automobile developments brought together the Federal Government and the forty-eight states in a common highway enterprise. Railroads, busses, pipe lines, and electric super-power nets need no introduction to the engineer as additional map-slashing agencies, driving cities, states, and nation to unique regulatory coöperation. Formal compacts, inter-governmental subsidies, and other novel devices are being tried, rapidly bringing to a close a long era of narrow provincialism in government.

**The Problem of the Expert.** Inevitably this phenomenal growth in the engineering functions of governments and changes in the relations of governmental units have raised a third problem: that of the expert. Noting the free and easy manner in which totally incompetent voters often undertake to pass upon difficult technical matters, such as the necessity for enlarging the Erie Canal in 1903, radical thinkers sometimes go to the extreme of advocating the replacement of democracy by dictatorship. Viewing the mysterious processes by which judges and juries, when confounded by the testimony of rival "scientists" before the courts, reach verdicts, even conservatives are alarmed. Perturbed by the careless fashion in which the Congress of the United States ignored physical laws in apportioning broadcast facilities among the states and possessions, radio engineers bemoan their position. Amazed at the spectacle of the popular election of a state geologist, during which laymen were called upon to weigh the qualifications of each candidate when they knew nothing about his field, some

students of political science recommend a reduction in the sacred right of every citizen to elect scientists to office.

And so it goes. A dividing line is being drawn by students of government between the "plain people" and the "expert." To allow the expert to manage public affairs unhampered by popular control may deprive government of the broad perspective and wide popular support necessary to its endurance. Certainly it gives free play to persons possessing special skills to further their selfish aims, irrespective of the general good. The expert must unquestionably be checked. But by whom? The uninformed citizen, if placed in charge of selection and criticism, is perforce liable to be ridiculous and even defeat his own ends in securing competent government service. So there seems to be no arbitrary solution of the problem. The technological expert, a product of the new age, has burst in upon historic government practices, confounding simple theories of political science inherited from ox-cart days and offering few clues as to procedures suitable for modern days.

### THE MOVEMENT OF ENGINEERING THOUGHT

There are many evidences that engineers are beginning to recognize the vital relations of their science to government and to the society which government serves. Proof is to be found in books and articles on the subject which have appeared during the past twenty-five or thirty years. A survey of this material indicates the direction in which engineering thought is moving.

**Machine and Plant Economy.** At the outset, of course, engineers were intensely occupied with the mechanical aspects of their work—with the nature of materials and forces, engines, tools, and machines. They were primarily concerned with improvements looking to efficiency—new devices, the reduction of friction and other heat losses, the accomplishment of the utmost work with the least expenditure of energy, human or mechanical. In their quest for effi-

ciency—the largest possible amount of work at the lowest cost of energy—engineers soon moved from the engine or machine itself to the relations of engines and machines to one another in the same plant or in different plants. Thus they gave attention to the shop set-up, arranging machines with a view to achieving the utmost economy in the plant as a whole.

**Efficiency Management.** The next step was to consider the human element. Machines did not grow like weeds, or manage themselves when installed. Even in the most efficient plants some human beings were employed as operators, tenders, and directors. Materials had to be fed to machines and the passage of materials through machines had to be supervised. Here the human element entered engineering. About a hundred years after the invention of the steam engine, engineers began to give considerable attention to this element and at the opening of the twentieth century a new movement in the United States, led by Frederick Winslow Taylor, was launched. What was the use of reducing losses from engines and plant set-up and allowing the continuance of great losses from maladjustments in the relation of directors and operators to their machines? The question answered itself. Hence thousands of studies were made of bodily motions in connection with work, and of heating, lighting, ventilation, sanitation, and other conditions bearing on the efficiency of labor.

**Community Efficiency.** In their search for increasing efficiency, engineers took the next step. Why establish ideal conditions conducive to human and machine efficiency in the given plant only to have them offset by adverse conditions outside the plant—in the community where plant directors and operators lived? Why, for example, create a model ventilating system in the plant and yet have operators come to work fatigued from dark ill-ventilated homes, in overcrowded trains at that? Again the efficiency engineer confronted an unavoidable answer. So he worked



outward from the machine and plant set-up, and human-machine relations in the plant to the living conditions of operators outside the plant. Many model industrial cities in Europe and the United States bear witness to this movement, and the growth of interest in city planning is testimony to the widening thought among engineers. To be sure, other forces entered into these developments. As the engineer moved outward from his plant, he met the economist, the specialist in public health, the architect, the artist, and the social reformer, all inquiring into the living conditions associated with machine industry.

**The Economics of Technology.** Other events made thoughtful engineers take their eyes off the internal nature of their machines to look about in the world at large. Machines, they discovered, did not exist for themselves. They were used to make goods by the millions of tons or billions of units. If these goods could not be sold or consumed, the machines could not run, no matter how efficient they were or how competent was the plant set-up. With new inventions and increased efficiency, the number of human beings employed in the manufacture of a given quantity of machine-made units declined. Indeed long ago engineers began to see that, taking industry as a whole, the amount of human labor per unit of output was declining. Every step in efficiency accelerated the decline. At last in 1932 this startling fact was dramatized by the findings of the "technocrats." In the end distinguished engineers came to the startling conclusion that their very quest for efficiency in the machine and in human relations to the machine was throwing people, for whom the machines presumably exist, on the scrap heap; it was apparently leading to a fundamental crisis in industry. They pointed to a time when increasing efficiency would reduce the employment of labor to a perilous minimum. If the employment of labor was to diminish, how could millions of people without jobs manage to buy the swelling output of machines? At all events, as Walter Polakov has

put the case, if there is no such thing as technological unemployment there is painfully evident to engineers an enormous amount of technology unemployed and technologists as well.

In all these searchings, engineers came into contact with government—government as the agent of the community, state, and nation. If the city was to be planned with reference to scientific standards of efficiency in health, transportation, housing, and life generally, the city or state government had to take action, make and administer laws. If the problem of unemployment in industry was to be handled, the state and national governments had to take action—how much and in what direction could not be determined off hand. Since machines and the material resources on which they are based are objects of property, since governments make laws determining the nature and uses of property, it was clear that efforts to extend efficiency throughout machine industry would encounter the forms and processes of government at many points. Working out from their machines in a search for efficiency, therefore, engineers ran into economics and statecraft and were compelled either to turn back to pure mechanics or to think harder than ever in related fields.

**The Nature of Engineering Thought.** In thinking about these wider issues, was the engineer to make of himself an economist or politician? Either was impossible; his training and science would not permit this change. He had to apply the methods with which he was familiar to the problems in hand. And what are these methods? In other words, what is the nature of technology? No comprehensive answer can be attempted here but a few fundamentals may be set down.

First of all, the several branches of technology are, for practical purposes, reasonably exact sciences. An engineer, when he constructs a bridge or machine, feels quite sure that it will work as designed. Sometimes he makes mistakes but that is because he is not enough of a scientist. As a scientist,

the engineer deals with the known laws and properties of materials and forces. When he builds a steam electric-plant, he brings all the relevant materials and forces into his scheme; he expresses them in mathematical terms; and he can be certain in advance that, barring accidents, his scheme will work as planned, designed, and built. As an exact science, engineering differs radically from all the so-called sciences which deal almost entirely with human beings.

In the second place, engineering is essentially *planful* in its nature. The engineer does not start on a task until he has made a blue print of it—a realistic picture of the precise form it will take when finished. Order is the first law of technology. Engineering abhors chaos. As engineering thought has moved outward from machine design and operation to the wider relations just mentioned, it has, of necessity, carried its habit of thinking in terms of plans and order along with it. When it turns, let us say by way of illustration, from machines for pumping petroleum to the oil industry as a whole, engineering must think in terms of plan and order in the whole industry if true to its science. For this reason engineering has also been called centripetal; that is, it tends to draw together all relevant operations in a single, planful whole. Thus it marches resolutely on disorder and chaos in its field of observation and work.

Being exact, planful, mathematical, and centripetal, technology induces the engineer to follow a *rational* method; he must proceed by examining the relevant facts he assembles, he must consider the precise ends to be attained, and adopt practices calculated to attain the ends. Then he can apply positive standards for discovering whether the ends have really been attained by the means utilized. He is not concerned with traditions, rumors, loves, and hates, however old or cherished. He begins by looking over a situation with an eye single to the salient facts—by asking: "What are the purposes to be realized by this or that machine, organization, or practice?" He advances by inquiring: "Does the machine,



organization, or practice effectively attain the alleged purposes? If not, what changes, adjustments, and adaptations are required to reach the posited goal?" In other words, technology brings to the consideration of government the cold *rationality* of exact science. What effect this procedure, now in its pioneering stage, will ultimately have on political science, it is impossible to foretell; but as engineering thought moves forward from machines and engines to their social and political implications, the rationality of technology will be applied. The movement, in truth, has already begun and students of engineering who rise above routineering will be forced to take note of it. Perhaps the day is not far off when technology, economics, and political science will really be merged.

**Obligation of the Engineer to Society.** From this statement of facts it appears that the contacts of the engineer with government are numerous, complex, and fundamental; and if he is to rise above the level of the mechanical routineer, he must take account of them. This is the case presented in its narrowest and most practical terms. If, however, the engineer considers his relations with government in all their ramifications, his thought is widened to include the continuing and increasing impacts of technology on government and industrial society with which his fate, in common with that of all citizens, is closely linked. This obligation he can scarcely escape, even by seeking refuge in specialism, by putting on thick blinders. The functions of industrial society and government are so largely technological in character that the engineer will, whatever his personal views, occupy a central position in the future; his science will become more and more indispensable to the conduct of government and the stability of industrial society. Already he is called to the bar of judgment and asked to render an account of his science and its offerings to a society perplexed by technological difficulties.

## CHAPTER II

### POLITICAL BOUNDARIES AND JURISDICTIONS

Of necessity the engineer operates in an area of space, small or large, with material things and an organization of human beings. When he is engaged in the transport of goods and in communications, his area of operations is likely to be large; he may be directing a world-wide radio broadcast or a transcontinental railroad line. As a result, his enterprises are almost certain to cut across many political boundaries, international or within the nation, even though his immediate center of action may be a single city or county. Inasmuch as order is indispensable to the continuity of his processes, and government, local, state, national, and international, supplies the order, the engineer must accept government as a condition precedent to the existence and functioning of his work. In operating with material things, he deals with objects of property, and government declares what objects shall be deemed public or private property and regulates their use. In organizing and directing human beings, the engineer encounters human rights, such as the right to physical security against dangers to health, life, and limb, the right to organize, the right to strike, the right to certain standards of life. All these rights are defined and enforced against the engineer by governments, local or general, or both. In short, the engineer works within and across political boundaries and under the jurisdiction of one or many governments. For him this is as inescapable as the law of gravitation.

"American government" is, in fact, a misleading term. There is not one. There are now 195,000 American governments—Federal, state, and local. Consequently the engi-

neer, when faced with a particular technological issue in government, first has to decide as best he may what unit or units really control the situation and this preliminary judgment, of course, involves a general familiarity with the respective geographical and legal jurisdictions of various public bodies. Perhaps a survey reveals that several authorities have partial powers in connection with the matter at hand. If such is the case, a knowledge of ways and means of securing their coöperative assistance is imperative. Hence the problem of political boundaries is our point of departure for a detailed study of government.

### POLITICAL UNITS

**The Nation.** States constitute the original source of political powers. At the close of the American Revolution there existed thirteen independent states, each with sovereign rights. None of them wished to give up its newly-won autonomy for the sake of a strong central organization. On the other hand, complete freedom for each unit brought about an intolerable situation. So a compromise finally was effected; the states federated in 1789, reluctantly relinquishing certain essential powers to a National Government. The nature and extent of this surrender are set forth at length in our fundamental document—the American Constitution. Chief among the powers thereby granted to the Federal Government, as they now touch technology, are the following: control over patents; the regulation of interstate commerce, whether by rail, pipe line, telephone, telegraph, or alternative means; direction of military defense by land, sea, and air; the management of foreign affairs and regulation of foreign commerce, involving international radio, cables, and shipping; and the supervision of navigable waters, comprising the licensing of hydro-electric or other developments on important streams. Although having legal jurisdiction over a host of matters of technological significance, the National Government is more or less helpless in regard to many more, as we shall soon see.



**Counties.** Just as the states have turned over to the Federal Government certain powers, so they have relinquished others to localities, among which stand a variety of units. Largest of all, as a rule, in point of area, are the counties, into which every state is divided (except Louisiana with its parishes). Altogether there are some 3,000 of these agencies in the nation as a whole. To the counties are given, at the will of the state, whatever duties seem fitted to decentralized management. The technological obligations thus thrown on the county include the maintenance of local roads, the supervision of health, the operation of hospitals, the running of airports, and, in one case, even the generation of electricity.

**Cities and Towns.** Counties, in turn, are usually, although not always, split up into smaller units. For the management of the more sparsely populated areas, townships or towns are often established. Again, the state decides what local functions shall be discharged. Compact settlements, naturally, call for a special form of government. Minor communities are commonly organized into villages, boroughs, or incorporated towns; larger centers into cities. The number of inhabitants requisite for the setting up of the former types of bodies varies from place to place—a mere 500 persons may be deemed quite sufficient. Generally a considerably larger total is required for cityhood—10,000 being the minimum in New York State. Although ambition prompts the average village to seek the rank of city as soon as possible, there are exceptional cases where villages materially exceed cities in point of population, containing as many as 20,000 or 30,000 persons. To both villages and cities are given, at the will of the state, powers regarded as commensurate with their respective urban needs. These include such rights as the authority to operate water-supply and sanitation systems, to fight fires, to pave streets, and to build bridges.

**Special Districts.** Newcomers in the political field are the so-called special districts. These units are organized

for the more efficient discharge of single duties—such as flood control, fire protection, sanitation, or bridge construction. Although they may cover regions already split up into other territorial frames for local government, they remain essentially independent of the latter. Like counties, villages, and cities, special districts may be created or destroyed at the will of the state.

**States.** Shorn of certain privileges, through transfer to the Federal Government, and having temporarily surrendered other powers through delegation to local political agencies, states exercise all the rights that remain. The regulation of public utilities—water, gas, electric, telephone, telegraph, railway, bus, or pipe line—is now largely a state duty. States construct and operate the main highways, supervising motor vehicle design and traffic at the same time. New York runs the famous Erie Canal. States license professional engineers; they safeguard public health by testing foods for purity, inspecting processing plants, and checking up water-supply or sewage disposal designs; they control weights and measures; they charter corporations; and so on, through a long list. Since states are in a position to recapture authority from local units, at least by constitutional amendment, expansion of functions is common.

**Washington, D. C.** Outside of the forty-eight states lie other areas, still within the confines of American jurisdiction but possessing unusual forms of government. The oldest of these is the District of Columbia, carved out of Maryland in 1790 to form the capital of the country. The District now comprises about seventy square miles, all of which are subject solely to Federal authority; Congress makes the laws and a commission appointed by the President and Senate carries on the administration of the District. The inhabitants have no vote, and therefore no power over the direction of their affairs.

**The Possessions.** Through war and purchase, a strange array of possessions has been accumulated by the United

States. Alaska was bought from Russia in 1867. Hawaii was annexed by a joint resolution of Congress in 1898. The defeat of Spain, in the same year, resulted in the acquisition of three new areas—the Philippines, Puerto Rico, and Guam. American Samoa was obtained much more quietly, in a final arrangement with England and Germany in 1899. The need for a canal across the Isthmus of Panama led to the purchase of control over the Canal Zone shortly after the turn of the century. A decade and a half later, in 1917, financial troubles induced Denmark to sell the Virgin Islands to the United States. Finally, the American flag has been hoisted over many small islands, discovered by passing vessels and retained primarily because they contain useful deposits of guano fertilizer. Many of them are so barren and so far away from the mainland as to be of slight importance. Surveying this collection of regions, spread out over half the circumference of the globe, we find a variety of climates, ranging from the ice and snow of Point Barrow, Alaska, in latitude  $71^{\circ} 25'$  North to the tropical heat of Rose Island, in latitude  $14^{\circ} 32'$  South. Akin to the wide scale of temperatures is a motley assortment of natives, from Eskimos to South Sea Islanders. Novel indeed are the responsibilities placed on American shoulders by the relatively sudden acquisition of this far-scattered and diverse empire.

It seems to be the consensus of opinion that the natives who inhabit the several possessions are not as well equipped to rule themselves as are citizens on the mainland. Consequently the elaborate system of states, counties, towns, and cities described above has not been applied wholesale to the colonial empire. On the contrary, a series of special political organizations has been devised to meet unique situations. At this writing, each region has a general government of its own. The highest type exists in Alaska, Hawaii, the Philippines, and Puerto Rico. Each of these areas has won a large measure of autonomy. Less independent are the Virgin Islands, where interference with local affairs



on the part of Federal agents is more in evidence. At the bottom of the scale stands the remainder of the possessions. Naturally the efficient management of the Panama Canal calls for strict discipline. For this reason, the Canal Zone is under the direction of a group of officials immediately responsible to national authorities. Guam and Samoa, being useful as warship bases, are controlled by American naval officers, with the incidental guidance of their superiors. As for the miscellaneous guano islands, the absence of inhabitants, in numerous cases, obviates the necessity for government. Where people are present, maritime law is applied, the small aggregations of rock being ruled like vessels, not a surprising arrangement in view of their distance from other shores.

Subordinate to the general government in each region of this empire are numerous local units. Largest of all are such areas as the counties into which Hawaii is divided and the provinces of the Philippines. Within these major divisions are legal entities known as municipalities, corresponding to cities and towns in the United States. Alaska permits any settlement of 300 or more persons to organize itself into a political authority, no distinction being made between large and small places.

**Engineers Deal with Many Units.** Amidst the network of political units and jurisdictions just described, the engineer performs his work. Often he is subjected to simultaneous control from several types of governments operating within the same territory. Thus if he is in responsible charge of the erection and subsequent management of a truck factory, he may have dealings with three bodies. Through its building code, the city in which the plant is to be located may impose limits on the design and erection of structures. State laws in the hands of officials closely define the permissible size, weight, and speed of his product. Finally, freight rates on shipments of new vehicles to consumers in other states are regulated by national agents. But the exact line at which

the powers of one group end and those of another begin, unfortunately, is far from obvious in many cases. Railroad regulation, for example, has been accompanied by court litigation in which contestants have sought to separate the legitimate spheres of Federal and state action. Disputes over divisions of duties between governments make the determination of the respective powers of each in a given region difficult.

After a survey of existing divisions of power among governments has revealed the type or types of units that may control a given technological enterprise, the next step is to discover the name, locus, and powers of each one of the specific bodies involved. The latter procedure hinges upon a careful study of the geographic situation of an undertaking with respect to national, state, territorial, or local boundaries. If a certain enterprise lies on one side of a given meridian, street, or mountain, it may be regulated by one authority in accordance with its special policies; if it falls on the opposite side, an entirely different set of laws, adopted by another authority, may be applicable. If it is spread across a series of boundaries all kinds of complications may arise from the varied activities of several governments. The precise location of political boundaries, in relation to engineering plans, is obviously of fundamental importance to technicians in charge. For this reason, it is pertinent to inquire into the manner in which the position of these vital lines has been fixed.

No hard and fast rules were applied in determining the proper extent of the territory that should be assigned to units of government. Alaska, for example, stands out as our greatest giant, for the combined area of our three largest states is still considerably less than that of this northwestern outpost. Next in line is Texas, covering 265,896 square miles. At the opposite extreme is Rhode Island, occupying a mere 1,248 square miles. Similar discrepancies in the matter of size are to be found among local administrative districts.

Custer County, Wyoming, spreads out over 20,000 square miles, being notably bigger than any of the seven smallest Eastern states. Bristol County, in Rhode Island, by way of contrast, covers only twenty-five square miles. What is true of counties is also true of towns, villages, and cities. Giant and pigmy jostle for places in our national scene. Chaotic variety is characteristic of our political boundary systems.

Explanations of this variation are easy to find. For convenience in staking out virgin territory, various arbitrary practices were employed. Where inhabitants were few and far between, the carving was done with a bold hand, in great pieces; where dense settlements were common, more delicacy was employed and finer cuts were made. As for shape, uncharted land called for unique practices. Straight lines, run along parallels of latitude and meridians of longitude, could be adopted by distant officials as final, even when they did not yet know the topography of the region involved. Consequently many states, counties, and towns end abruptly at due North and South or East and West boundaries. Where prominent natural features were available, they were, of course, also utilized. Thus the Great Lakes, the Mississippi, Ohio, and Columbia Rivers, and the Allegheny and Rocky Mountains mark shifts of authority from one political body to another. Our political geography represents the hasty division of a continent rather than a careful plan based on a detailed study of the character of the terrain.

**Haphazard Nature of Present Jurisdictions Creates Problems.** Because of their more or less haphazard origins, our political boundaries cut across a multitude of engineering enterprises. Due North and South or East and West lines, run out by reference to the sun and stars but with no regard for geological structures, are bound by the laws of chance to slice through oil, gas, coal, and iron fields. For instance, the Oklahoma-Kansas frontier, following the 37th parallel of North latitude, traverses the heart of the famous mid-continental oil field. The Ohio-Indiana border is just as



arbitrary, splitting in twain a second important petroleum basin. Although serving as convenient landmarks for the subdivider, rivers often form unsatisfactory boundaries from an engineering standpoint. Unified plans for our greatest seaport suffer from the fact that the main waterway of the harbor, the Hudson River, separates two states, leaving some docks on one side in New York and the remainder on the other side in New Jersey. The Ohio River, acting as a portion of the boundaries of five states, presents unique sanitary problems, with mounting river pollution—problems with which no one state government can cope when operating alone.

From the foregoing discussion, it should be readily apparent that the engineer may have frequent occasion to deal with a series of governments simultaneously. Considerations of efficiency dictate that he secure as full a measure of coöperation from the varied authorities involved as is possible in the circumstances. This requires a knowledge of technique. Fortunately he does not have to depend solely upon his own inventions to achieve success in this direction, for a number of processes for getting political units to work together have already been tested in the school of experience. These, of course, differ according to the types of bodies concerned. Certain practices are satisfactory for the solution of international situations, some are useful in settling interstate difficulties, and others prove helpful in intercommunity difficulties. It is to these methods, in the order named, that the remainder of the present chapter is devoted.

### FOREIGN RELATIONS

**Complete Isolation Impossible.** Washington, in his farewell address, advised his countrymen to extend their commercial activities abroad but warned them against political entanglements. "Europe," he said, "has a set of primary interests which to us have none, or a very remote, relation.

... It is our true policy to steer clear of alliances with any portion of the foreign world." But the business enterprises that Washington encouraged have, under the drive of science and machinery, tied the continents so closely together that the contacts with outside powers, which he feared, have become everyday necessities. The steamer, capable of spreading epidemics rapidly from port to port, radio and submarine cable communication systems across the Atlantic and Pacific, hydro-electric developments along the Canadian border, irrigation works on the Mexican frontier, races in naval armament, all contrive to make unreal the much vaunted dogma of isolation. Technology forces the United States to accept a certain amount of international agreement as a condition for the continuance of industrial society. The trend is significant.

**American Agents Abroad.** Upon the Federal Government falls the entire burden of managing foreign affairs. This duty it discharges through a permanent organization, with agents in many parts of the world. At the head of the unit stands the President of the United States, official spokesman for the country. Subject to his direction is the Department of State, which relieves him of whatever details he cares to entrust to it. Under a strong President it may be little more than a routine body for carrying out his will; under a less dominating man, it may actually control policies. Representatives of the Department abroad are of two varieties—diplomatic and consular. The former are grouped in several ranks, ambassadors being accredited to the major powers and ministers being dispatched to minor powers. Their prime task is quietly to iron out disagreements as fast as they arise. Consuls and their assistants seldom, if ever, have such ticklish tasks. They are administrators who perform routine functions such as issuing sailing papers to steamers and investigating market opportunities. In addition to the regular staff of foreign representatives mentioned above, there are numerous agents who care for the

special interests of the remaining branches of government, such as the Treasury Department.

Occasionally the President deals with foreign nations in a more direct manner. He may send personal representatives to other countries, rather than rely on regular ambassadors. Woodrow Wilson went a step farther. At the close of the World War he journeyed to Europe and there personally took a hand in the process of drawing up the peace treaties. An equally unusual departure from precedent, made possible by recent developments in the art of radio communication, occurred in 1931, when President Hoover, wishing to get in touch with European statesmen in order to discuss the debt situation, telephoned to them across the Atlantic. Certain Belgian newspapers, startled at the idea of heads of states talking together informally, lamented the circumventing of diplomats. Pointing out that the usual tedious procedure of having agents sound out parties was thus avoided, they feared the evils of precipitous action. Anyway the practice stands.

**Treaties.** When problems arise that cannot be properly settled by verbal understandings between American and foreign agents, resort may be had to formal written agreements. The most important of these take the form of treaties. Modes of preparation vary. Sometimes the drawing up of documents is performed by special representatives who go about their duties in a more or less secret manner. Thus the terms of a contract for the development of the St. Lawrence Seaway were worked out so quietly that the very existence of the negotiations was unknown to newspaper men, until after the deed was done. On the other hand, the operation may take on the appearance of a great public spectacle. When a complex mass of international radio difficulties had to be cleared up in 1927, it was necessary to bring together the greatest assemblage of delegates in the whole history of treaty-making. A general conference was held, attended by officers of seventy-nine governments as well as by a score of



spokesmen of private groups interested in the matters at stake. Progress reports appeared regularly in the press.

Upon completion, the draft of a given treaty is sent to the proper body in each participating country for final action. In the United States it is the Federal Senate that must pass upon the proposal. Perhaps the contents are not altogether new to its members for, by threatening to reject an impending agreement if excluded from the negotiations, they can often win the privilege of helping to prepare the document. Provided it is approved by a two-thirds majority of this chamber, the draft is next dispatched to the President of the United States. The latter must sign the treaty and publicly proclaim it to be in effect before it is binding on the American nation. Nor is the final step a mere matter of formality; if last minute news leads him to feel that American interests would, after all, be injured by the treaty he may refuse to attach his name, killing it then and there. Once in force, a treaty expires at the end of the period specified in the text. When no limit is set, it is assumed to run indefinitely, until either revised or canceled. Termination in such cases must be done with care and tact, so as not to offend the susceptibilities of other parties to the compact.

How rough the path of the treaty-maker may be, in actual practice, is illustrated by the history of the Panama Canal. Prior to the construction of that great link between the Atlantic and the Pacific, vessels bound from ocean to ocean had to sail hundreds of miles out of their way around South America, the northern passage being blocked with ice. A channel across the Isthmus of Panama was early suggested as a means of reducing this long voyage. Seeking to turn dreams into reality, the United States had to reckon with England, who offered competition in any race to cut through the narrow neck of land. In 1850 coöperation with Great Britain was assured through the consummation of the Clayton-Bulwer Treaty, providing for the supervision of a proposed canal by both nations. After the war with Spain, the

United States wished to manage the undertaking itself, without foreign assistance. To do this, the existing arrangement with England was replaced in 1901 by the Hay-Pauncefote Treaty, authorizing the United States to dig a waterway alone. In return for this concession, Great Britain insisted on a provision forbidding toll discrimination against vessels of any nation. Taking advantage of the latter clause, England opposed and defeated a subsequent attempt of Congress to grant special favors to American ships.

Besides negotiating with Great Britain over the management of the canal, the United States had to secure a suitable path across foreign soil. There were two possible routes—one by way of the Isthmus of Panama and the other through Nicaragua. Desiring title to both of them, the United States entered into a treaty with New Granada in 1846, followed by one with Nicaragua in 1867, assuring neutrality for completed works as well as equitable treatment for the nationals of the signatory powers. But before the Panama route was definitely fixed as the final line, and before operations were started, New Granada became part of the Republic of Colombia, forcing the United States to reopen the matter. In his efforts to obtain a right-of-way from Colombia long afterward, President Roosevelt was unsuccessful.

But conspirators appeared who offered to overcome treaty obstacles. They asked for help in carving the "Republic of Panama" out of recalcitrant Colombia, the new Republic conveniently to encompass the area required for building a canal. Although the United States refused formal assistance, it sent warships to the scene and soon after their arrival the revolt began. Within three days Panama was officially recognized as independent. The novel turn of events proved a boon to American engineers, for President Roosevelt had little difficulty in negotiating a favorable treaty with the recent arrival in the family of nations, at last clearing the way for actual construction.

With the treaty duly ratified, the Panama Canal was

rapidly pushed to completion. Today it stands as a monument to modern engineering skill. The total length of line, from shore to shore, is forty miles, made up of three locks, two lakes, and some cuts. Altogether 380,000,000 cubic yards of material were removed in the construction of the route, an amount equivalent to the contents of a prism fifteen feet square running through the earth from pole to pole. By utilizing the waterway, provided at an original cost of \$375,000,000, vessels save 7,873 miles in the trip between New York and San Francisco.

Many notable engineering enterprises, besides the Panama Canal, are governed by detailed treaty provisions. Since Niagara Falls lies partly in Canada and partly in the United States, the two countries finally adopted a water diversion plan for the benefit of their respective nationals. A considerable proportion of the total flow is made available to each party for hydro-electric purposes, the remainder being allowed to flow over the Falls to preserve the scenic beauty of that famous spot.

Turning to the world of wireless, we find the leading powers, except Russia, bound together by a compact under which orderly radio communication is carried on among all parts of the globe. A back-breaking race for naval supremacy, too, called for coöperative action. So the Washington Treaty of 1922 and the London Treaty of 1930 were concluded, closely limiting armaments on the sea, as far as the major types of warships of America, England, and Japan are concerned. Treaties involving technological subjects grow in number as science and machinery invade all spheres of life.

**Agreements.** International understandings are not always incorporated in formal treaties. On the contrary, binding agreements are frequently reached through the medium of an exchange of notes between interested diplomatic agents, without the intervention of the Senate. The number of minor adjustments that must constantly be made with other



countries is so great that an easy method is imperative for the smooth running of foreign affairs. The agreement was effectively employed in negotiations between the American State Department and the Canadian Legation, designed to secure reciprocity in aëronautics. After the exchange of several papers, a completed draft was approved by the officers of both powers. As finally accepted, the compact provides that Canadian aircraft, having Canadian pilots and Canadian licenses, may fly in the United States on the same terms as American aircraft in Canada. The complexity of treaty-making, contrasted with the simplicity of framing executive agreements, inevitably leads to numerous attempts to avoid delay and confusion by resorting to the latter. The border-line between matters appropriate to each type of action, therefore, is hopelessly blurred.

**International Governments.** Contracts, in the form of treaties or agreements, are usually carried out separately by the several associated nations. On rare occasions, however, such compacts are put into effect through operating units of international government. The most outstanding among the latter, in the field of engineering, is the International Joint Commission of the United States and Canada, charged with the settlement of technical disputes arising along our northern border. Organized under a treaty of 1909, the Commission consists of three American and three British members. Sitting as a court, it hears a wide range of cases involving hydro-electric power developments, pollution, irrigation, or navigation along the boundary waters, arriving at decisions by a majority vote. The orders of the Commission become binding upon both countries; hence it may compose many differences without resort to higher authority.

So important is this institution that in the first three years of its life the remarkable body finally adjusted more controversies between the two countries than had been jointly disposed of through the diplomatic agents of England and the United States since the very foundation of the

Government! What is still more amazing is the fact that the six Commissioners have always rendered a unanimous verdict on the basis of the technical facts at hand; national prejudices apparently never disrupt their deliberations.

In addition to its connection with the International Joint Commission, the United States is involved in the operations of many other coöperative bodies. Through the Universal Postal Union, American mail is distributed to all parts of the world, while foreign letters and packages are in turn transmitted to the United States for delivery. The Union not only formulates rules for the conduct of this vast business, but sees that each participating power receives proper compensation for its labors in the common enterprise. Two units, the Pan-American Sanitary Bureau, acting for the Western Hemisphere, and the International Health Office, covering additional territory, act as agencies for the interchange of information on outbreaks of epidemics likely to result in the carriage of disease by ships from port to port. By the terms of an understanding among several seafaring countries, an International Ice Patrol is conducted in the North Atlantic, having as its object the discovery of icebergs imperiling ocean travel. When bergs are located, their position is at once radioed to vessels steaming across the Atlantic. Serving as a medium for the checking of metric weights and measures throughout the globe is the International Bureau of Weights and Measures. Its good offices prevent discrepancies between national metric standards from reaching serious proportions. The United States is also associated with research groups, such as the International Technical Committee of Aërial Legal Experts, engaged in the study of problems arising out of rapid modern movements of aircraft.

With the most famous and comprehensive of all international governments, the League of Nations, the United States is not directly affiliated. This body, binding together fifty countries, is largely the creation of an American President—Woodrow Wilson. Although he succeeded in convinc-

ing many other countries, he failed to win the support of his own nation for his plan and the United States Senate stood in the way, blocking approval. For various reasons, including fear of foreign entanglements, the United States has consistently objected to joining the organization. Nevertheless, in discharging numerous technical duties, the League has obtained its full or partial coöperation. While the United States is not a formal member, it has helped in many special inquiries and conferences, sending "unofficial observers" or official delegates to act as American representatives. Our relations to the League, then, are not simple or clear-cut; nor are they positively fixed by the refusal to join the League formally.

**Retaliation as a Weapon.** Retaliation in kind, as well as coöperation, is employed to safeguard American interests abroad. The process may best be illustrated by the submarine cable situation. Under congressional authorization, the President of the United States controls the issuance of licenses for the landing of cables. When a foreign wire is about to be brought ashore, he may prevent the connection from being completed until the country at the end of the line agrees to accord American citizens reciprocal privileges for their systems. For example, a British cable company secured monopolistic rights in Brazil. From Brazil it ran a wire to the Barbadoes. Later the Western Union Telegraph Company sought to join these British islands with Florida by a cable. But on attempting to execute the project, it was confronted by a formidable naval force, dispatched by Federal authorities to halt operations. It subsequently appeared that an American company wished to lay a competing route to the South. By shutting the English concern out of the American market, an effort was made to break down its Brazilian concession. Discrimination is a game that two can play.

#### INTERSTATE AFFAIRS

**Importance of Interstate Relations.** Closer to the concerns of engineers than foreign affairs, as a rule, are interstate



problems. Just as science and machinery have multiplied contacts among nations, so too they have created a genuine need for coöperation among states. When the thirteen original American colonies threw off British sovereignty, there was comparatively little commercial interchange among them. Travel by stage, on horseback, or by sailing vessel was uncertain, slow, and expensive. Agriculture, rather than manufacture, was the axis about which our economic life revolved. This historic isolation, however, was broken down by the advance of technology. Steamship, rail, bus, truck, pipe, and air lines provided means of easy movement from region to region while radio, telephone, and telegraph routes transmitted information with lightning speed. Under the drive of mass-production technique, the fabricating of goods for local markets was largely replaced by centralized manufacture and country-wide sales. California consumers buy automobiles and corn flakes from Michigan, aircraft from Kansas, books from New York, soap and steel from Pennsylvania, steam shovels from Wisconsin, and tractors from Illinois. Progress in technology has resulted in bold plans for super-power nets, flood control, and sanitation that encompass large sections of the land. Inevitably all kinds of relations between state governments spring out of engineering projects.

**Sphere of Federal Control.** Several important methods for resolving interstate difficulties have been evolved with the passage of time. Of course Federal authorities, under their powers over interstate commerce, can solve a number of problems by independent action, as we shall see. Federal action may also take another form. Where open disputes rage between states national judicial intervention may be invoked and Federal court orders issued, leaving execution to local bodies; for the national judiciary has the power to hear and decide disputes between the states.

By the judicial process, for example, a sharp contest over the Chicago Drainage Canal was effectively put to rest.

Chicago was established about a hundred years ago as a trading post at the lowest point of land between the Great Lakes and the tributaries of the Mississippi River. The divide here is so low that at periods of unusual rain and high lake levels, small boats were sometimes rowed up the Chicago River, pulled through marshes into the Des Plaines River, and floated down to the Mississippi. As the city grew, its water-supply was pumped from the Lakes and its sewage returned to the same source, resulting in serious outbreaks of disease. To get rid of its sewage, Chicago cut a drainage canal through the divide, diverting enough water from the Lakes to carry the wastes out the back door towards the Mississippi. The heavy flow thus created lowered the level of the Lakes about six inches, to the detriment of shipping. Seven Lake states, finding their interests injured by the act of Chicago, brought suit against that city. The outcome of this litigation was an order by the Supreme Court of the United States instructing Chicago to build sewage disposal plants and, as fast as these are completed, to reduce the diversion of water, the ultimate goal being a practical elimination of the evils complained of by her neighbors.

Less extensive in scope, but still illustrating an important process in American government, are a number of other water-supply problems which have been solved by the Federal courts. When New York City proposed to divert a portion of the sources of the Delaware River, to care for her rapidly growing population, Pennsylvania and New Jersey protested. A Federal court order ultimately settled the matter by assigning flowage quotas to all concerned. After Boston announced plans for taking water from the Connecticut River to meet growing urban needs, judicial authority was invoked and the flowage apportioned between Connecticut and Massachusetts. Finding her bathing beaches fouled with garbage dumped into the ocean by New York, New Jersey pleaded for relief. In the end the latter won a decision ordering the offender to adopt a more modern means of waste

disposal than that of dumping from barges at sea. Many an angry controversy between states has been brought to settlement in the quiet chamber of the Supreme Court at Washington.

**Interstate Compacts.** A peaceable settlement of interstate differences by "compact" is often preferable to the process of wrangling, leading to the courts. Two or more states may, under the American Constitution, enter into a formal understanding which, when approved by the Federal Congress, becomes binding on all parties concerned. The compact has been employed with marked success in connection with the development of the nation's leading seaport. The central waterway of New York Harbor is the Hudson River, on the east bank of which lies the state of New York, and on the west shore the state of New Jersey; the boundary line between the two states approximates the middle of the river. National authorities form still a third interested party, being concerned with navigation. And besides the major political units there are many municipalities in the harbor area.

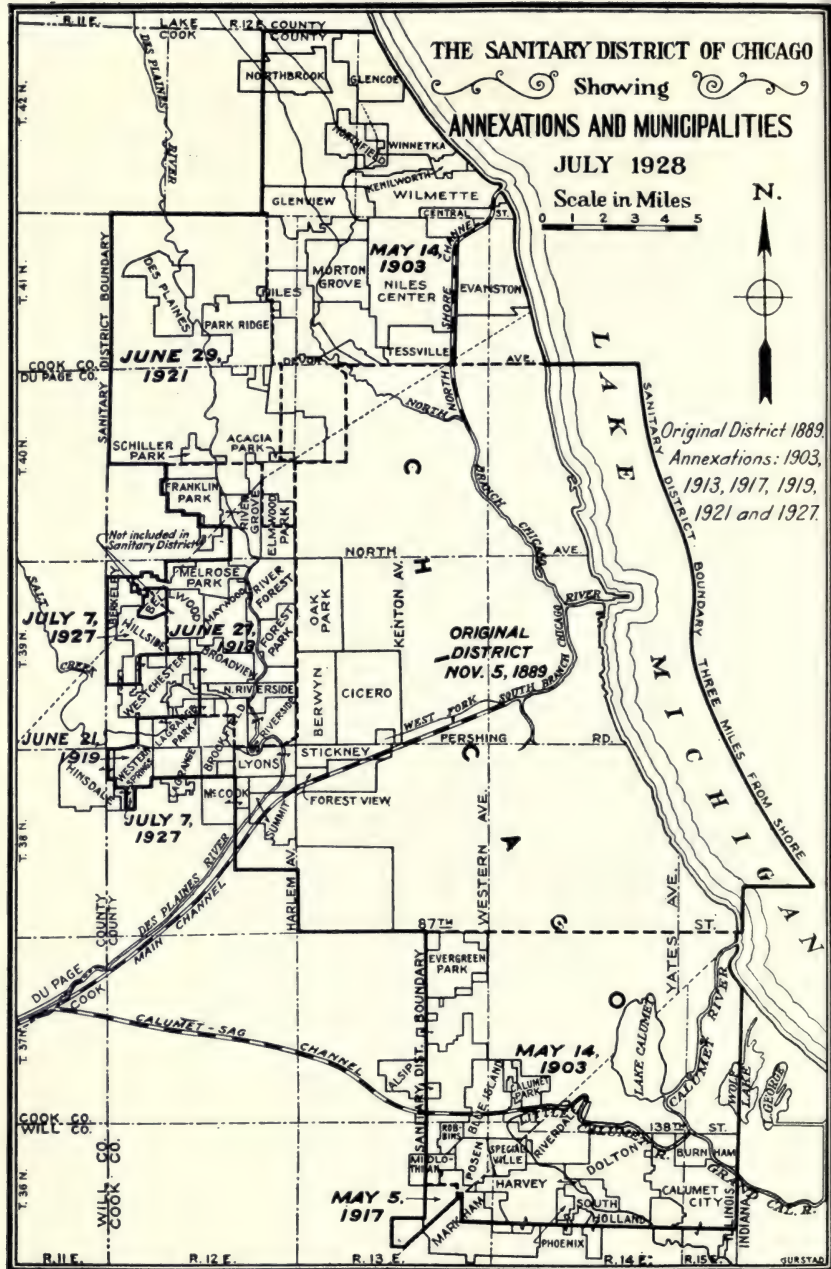
As time passed, the lack of coördination in the port sector became serious. Rival states and cities fought for trade. Intercommunication between terminals was hampered by local jealousies and remedial action was sorely needed. Eventually New York and New Jersey made an agreement which, duly ratified by Congress, became effective in 1921. The agreement laid out a Port of New York District, comprising 1,463 square miles and 185 municipalities in two states, a region inhabited by approximately one-tenth of the total population of the country. To govern certain operations in this impressive domain, the treaty set up a Port of New York Authority, consisting of representatives of both states. The Authority has already greatly facilitated transportation by building and administering several toll bridges as well as a tunnel. It has also begun the erection of terminals and has fostered the completion of a belt railway.



A most comprehensive engineering plan has been called into being by the compact.

Prominent in the development of the West is a second compact controlling the Hoover Dam project. Searching for a suitable reservoir site on the Colorado River for the storage of melting snows, engineers discovered ideal natural conditions in the canyons separating Nevada and Arizona. But the erection of regulatory structures was long blocked by serious political difficulties. The four states on the upper reaches of the stream—Wyoming, Utah, Colorado, and New Mexico—were already making partial use of the existing flow and expected to make even heavier demands in the future. Possible appropriations of water downstream, in connection with the proposed barrier, might, under Western law, win priority over contemplated upstream diversions, to the injury of these four states. On the other hand, Nevada, Arizona, and California, having lands within the lower basin of the Colorado, saw in the enterprise enormous hydro-electric, flood-control, and water-supply advantages. For a quarter of a century the seven states, divided into two rival camps, wrangled over the matter. Finally six of them managed to come to terms in a joint agreement which, after congressional approval, went into effect in 1929—Arizona still remaining aloof. The compact, so launched, assigned specified quantities of water to the upper and lower states respectively, satisfying both parties on that score. The erection of the world's most notable dam, in the Black Canyon, was authorized by Congress to form a mighty reservoir for the retention of waters allotted the lower basin. Use of the water at the dam was then given consideration in detail. Hydro-electric power obtained at the dam is to be apportioned among adjacent states on a pre-arranged schedule, giving public bodies preference over private concerns. Los Angeles and vicinity are to pay the United States for its services in regulating floods so as to assure a constant flow into city water mains. The great area involved and the







complicated governmental problems settled by this extraordinary compact put it in a class by itself.

**Federal Financial Aid to States.** Money, as well as judicial authority and compacts, may be employed as a lever to force states to coöperate toward some common end. Impressed by the general absence of good roads and wishing to promote the construction of a standard system of main highways, national authorities began in 1916 to extend financial help to the states. Under the plan, as now effective, money from the Federal treasury is apportioned among the several states, one-third on the basis of their relative areas, one-third on that of their respective populations, and one-third on that of their relative post-road mileages. In order to obtain the proffered funds, states first had to agree to abide by a uniform set of specifications, controlling all highways on which they wished to spend their shares. By this means, every state in the Union was induced to join in a concerted effort to foster general road-building. While the national authorities do not assist in the maintenance of completed structures, they threaten to withdraw further compensation from any state that fails to keep its Federal-aid roads in repair. By such extraordinary coöperative tactics, a truly national highway system has been spread out from coast to coast, permitting the traveler to pass over an unusually good grade of surfaces practically from one end of the land to the other.

Much the same happy ending is expected from new policies in connection with flood control on the Mississippi. States along that great river for years followed their own independent schemes for combating inundations. Inevitably the serious lack of coördination brought about unfortunate results. To cite but one detail, during critically high stages of the water level in 1927 Missouri structures affected citizens in two adjacent states. First, levees in Missouri forced water over lower barriers in Tennessee; then the former broke down, pouring veritable torrents behind dams in

Arkansas. Such cases attracted public attention. Although both Federal and local governments had already done a large amount of building, the need for more concerted effort was clearly apparent. Thereupon \$325,000,000 from the national treasury was set aside to complete existing enterprises and add others, in conformity with a single comprehensive plan. Regional rather than sectional conceptions prompted the move, just as they did in the case of highway construction.

**Uniform State Laws.** Viewing with concern the many conflicts in local policies covering technological questions, specialists in the subject have frequently advocated the adoption of uniform state laws to obviate such difficulties. The need for this step is widespread. For example, the automobile is cosmopolitan in its operations and should be treated in much the same fashion in all parts of the nation. Yet, in practice, motor vehicle rules are anything but uniform. In 1924 Herbert Hoover, addressing the National Conference on Street and Highway Safety, said: "There is no uniformity in traffic regulations. I could be arrested and convicted on a dozen counts between Washington and New York if I carefully followed either the Washington or New York traffic regulations." Government specifications for the design and equipment of cars, as well as rules of the road, are far from standardized. In the case of motor trucks, as shown in a 1930 survey, state laws are exceedingly divergent. The maximum legal cross-sectional area of trucks varied from 12'  $\times$  7' in Florida to 14' 6"  $\times$  8' in Alabama, seven intermediate sizes being found elsewhere. Greatest allowable overall lengths, too, covered a broad scale from 28' in New Jersey to 40' in Michigan, for single vehicles, while for a combination of truck and trailer the range was from 60' in California to 85' in New Jersey. Weight, after the manner of size, was subjected to dissimilar restrictions. The peak gross loaded weight of trucks ran from 18,000 pounds in Maine to 30,000 pounds in Connecticut. Nor is

the predicament of the truck exceptional; the possible field of action for the uniform state-law movement includes engineer license requirements, daylight saving time, and many other issues.

Fostering interstate coöperation in this direction is the National Conference of Commissioners on Uniform State Laws. The Conference is composed of representatives from all the states and from the territories and possessions, the members serving in a semi-official capacity. Working through a series of committees, the organization has prepared numerous uniform acts, four of which touch the engineering field. These four deal with aëronautics, cold storage, motor vehicles, and public utilities. Supplementing the agency mentioned above, is the periodical National Conference on Street and Highway Safety, which has prepared a general motor vehicle code. Several other bodies composed of official representatives are directing their efforts to the common end of promoting coöperation among the states and other governmental units.

Many important results have been achieved through the endeavors of the several agencies working for uniform state laws. Especially satisfying in this regard is the present policy of adhering to a single standard for the operation of aircraft. The Federal Government, fortunately, began to regulate aviation before most of the states had attempted similar control themselves. Viewing with favor the initial efforts at Washington, one state after another fell into line with the central system. So thorough has been the coöperation of the states that thirty-four of them now require that national licenses be secured prior to engaging in local flying, or they permit operators the choice of taking out either a Federal or a state license. Of the remaining fourteen states, eight have no general laws regarding aircraft, leaving only six states where Federal licenses are insufficient. Uniformity of such character has been a marked boon to aëronautics; it has permitted the manufacture of craft on a given pattern



for sale in almost every section of the country—something that would have been impossible under conflicting laws. The cruising radius of modern planes is so large that divergent state policies would have seriously hampered the transportation of passengers, mail, and goods by air.

Although less extensive in the range of their success, other uniform state laws still deserve mention. The standard cold storage act, prepared by the National Conference of Commissioners on Uniform State Laws, has been put into effect by six state governments. The National Conference on Street and Highway Safety reports even greater victories for its general motor vehicle code, which has been adopted as a whole or in substantial part, or has been used as a basis for revising existing laws, in approximately half the states.

Nevertheless certain inherent difficulties confront the movement. Complete uniformity is not always desirable. Speaking of automotive headlighting, Motor Vehicle Commissioner Stoeckel of Connecticut pointed out that lamps should be designed to afford visibility in advance of a car commensurate with its speed. In Connecticut, where conditions demand much lower velocities than on the long straight roads of Michigan, bulbs should be correspondingly smaller. Hence account must be taken of differences in technical needs from section to section of the country.

Even when a maximum agreement on conditions has been reached, mere labors on general legislative enactments are not enough. Often administrators possess the power of working out detailed requirements in the form of "rules." If the latter are not alike, confusion continues unabated. Thus a committee studying the problems of remedying conflicts in boiler codes reported that, since executives in the several states had been granted sweeping privileges in the preparation of regulations, it could not cope with the problem by considering laws alone. Occasionally attempts are made to deal with rules also; the Eastern Conference of Motor Vehicle Administrators brings officials together with

a view to securing standard regulations in the territory served by its members. Unfortunately there is still another complication in the way of uniform practices. Courts in a number of states may interpret a given measure in many different ways. A phrase may mean one thing to one judge and something else to a second. Rough indeed is the path of the engineer who wishes to put into general effect a single policy.

### REGIONAL PROBLEMS

**Nature of Regional Problems.** Technology has destroyed the isolation of local governments even more thoroughly than it has that of states and the nation. Where independent communities are crowded closely together in a metropolitan area, it may be wholly impracticable for each to build its own water-supply system of modern type. Perhaps access to proper sources is readily available to only one of them, or perhaps the cost of necessary works proves prohibitive unless spread out over a considerable group of units. So, too, a municipality often finds itself cut off from suitable sewerage outlets by intervening towns. Transportation presents further problems. Important streets may be dead-ended at a city limit, or continued with much narrower width. Rapid-transit facilities, bridges, and tunnels may involve several authorities. Inadequate fire-fighting equipment or fire inspection in a given section may permit conflagrations to sweep across a series of boundaries and wipe out large areas. Disease is no more a respecter of local lines than is fire; consequently health work requires concerted efforts over wide regions. In an age when criminals can rush away from the scene of their actions in high-powered cars, intercommunication between police officers in charge of adjoining territories is imperative. Shipping today, with its emphasis on size and speed, frequently calls for the united action of two or more communities to provide proper harbor facilities. Even electrical super-power nets, tying together

nearby municipal plants, have been tried. In our technological age, regional, rather than municipal, concepts predominate.

**Voluntary Coöperation.** Occasionally units of local government are able to solve common problems by voluntary coöperation. Municipalities are not perfectly free, though, to follow their own desires in this direction, for the state must usually give its consent before contemplated action may be taken. Applications of the method are to be found all about us, the history of the Brooklyn Bridge being typical. Previous to 1898 the cities of Brooklyn and New York were independent entities, both situated in New York State and facing each other on opposite banks of the East River. Under state charter, a private company began to build a bridge over the stream. Taking advantage of a privilege accorded them by the state, both cities decided to buy out the rights of the concern and complete the bridge themselves. To serve as a governing body for the mammoth enterprise, a joint board consisting of ten representatives of each city was created. Costs were divided, Brooklyn paying two-thirds and New York the remainder. The new agency ultimately completed the structure at a total cost of some \$17,000,000. With a clear span of 1,600 feet it was long one of the marvels of engineering science.

Voluntary coöperation has also proved of value in building sewers, fighting fires, and in the management of police teletype nets. Instances of successful voluntary coöperation are, nevertheless, relatively rare. Typical of the sort of local jealousies that wreck many joint undertakings was the rivalry that existed between two Minnesota cities over a common bridge connection. When Henry Ford announced his intention of building a large automobile plant in St. Paul, the project was greeted with enthusiasm. After the arrival of the new factory, Minneapolis sought to secure the wholehearted help of St. Paul in throwing a structure across the river that separated them. But work on the inter-city link



dragged. Finally Minneapolis accused St. Paul of trying to hold it up until all Ford workmen had been driven by a lack of transit facilities to settle in the latter place. Indeed it is not often that the requirements of two communities are so similar as to permit of a perfectly agreeable compromise. Consequently resort must often be had to higher authority if positive action is to be secured.

**Compulsory Coöperation.** When two or more localities find themselves unable to get together on a joint enterprise, the state in which they lie may step in and order them to do so. This mandatory power was used in connection with the Harvard Bridge. The cities of Boston and Cambridge face each other on opposite shores of the Charles River. After two unsuccessful attempts to win the help of Boston in erecting a bridge across the Charles River, Cambridge appealed to the state of Massachusetts. After listening sympathetically to the Cambridge petition, the legislature flatly told Boston that she must assist in building the desired link, each municipality to assume half the total cost. A commission, consisting of one representative from each place and a third selected by the two so chosen, was formally put in charge of the construction and finished its task by opening the Harvard Bridge in 1891.

Reference to current engineering work reveals numerous other cases of state intervention. New York City was compelled by state act to coöperate with communities along the line of its main aqueduct to the extent of furnishing them with water. The superior arm of the state, then, by main strength, may force municipalities to achieve what they are incapable of achieving merely through friendly advances.

**Extra-Territorial Activities.** Occasionally a municipality carries on engineering activities of its own at a considerable distance beyond its boundaries. In their search for water, cities must frequently tap remote sources and carry the supply through long aqueducts to teeming metropolitan centers. New York and Los Angeles both operate water-

works extending a hundred miles or more beyond the city limits. This development springs from a realization that localities cannot be completely hemmed in by arbitrary geographical lines, if they are to function successfully; but they cannot be permitted to extend their jurisdiction arbitrarily over hundreds of square miles of rural property just to secure water or obtain sewer outlets.

There are real dangers in granting cities too much free play in this respect; restrictions are necessary in practice. By state law, cities are commonly authorized to perform only those extra-territorial duties which are primarily of benefit to residents of the city and not to the people outside. The construction of a municipal water-supply serving a given city, but only incidentally if at all the surrounding area, is perfectly legitimate under this rule. On the other hand, the building and maintenance of an electric plant to furnish current for distant rural districts, to the special advantage of the latter, raise many questions of policy not yet settled. When engaged in pursuits beyond their borders, in their own particular interests, cities possess the rights of private utility corporations, being enabled thereby to condemn land and erect structures.

**Annexation.** Where existing local boundaries constitute a barrier to engineering enterprises, despite attempts at coöperation or extra-territorial developments, the logical thing to do is to shift the offending political lines, if possible. The extension of city limits commonly takes place by annexation. Procedure varies with the section of the country involved. Frequently complete fairness to interested parties is assured by state law, the consent of both the annexing city and the region to be annexed being required. Often the region to be absorbed is given the right to pass upon its future by popular vote, while the government about to do the annexing settles its side of the question either by popular vote or by the action of its legislative body. Replacing voluntary practice in a few instances,

the law permits compulsory steps to be taken. In Missouri, state statutes permit every municipality, except St. Louis, to annex contiguous tracts through the mere passage of a municipal ordinance. Where two cities attempt to seize upon the same property, the one that passes the proper ordinance first wins the area in dispute. While such an arbitrary policy prevents small political entities from blocking great metropolitan plans, it may at times work injustice to little places. Whatever the method, annexation enables cities to stretch out as the needs for growth dictate.

Technological motives for annexation are numerous. A striking development along this line recently occurred in connection with a noted Western enterprise. In 1915 Los Angeles started work on the Owens River aqueduct, running through the San Fernando Valley. Residents of the latter tract, being unable to obtain sufficient water on their own initiative, asked to be accommodated from the Owens River water-supply. Los Angeles refused to consent to the diversion except on condition that the Valley agree to become a part of the city. Finding themselves in a serious predicament, the citizens of the region ultimately voted in favor of annexation, and the process of absorption was carried out. By similar methods a number of additions were made to the City of Boston, Massachusetts.

Sewerage construction, too, is often involved in the process; Roxbury, West Roxbury, and Dorchester, for example, decided upon annexation to Boston largely to end an insufferable pollution difficulty. Possible outlets for sewers in the three places invariably cut across outside territory. Balked in their attempts to build the needed outfalls, the three urban centers allowed their several channels to become clogged with wastes to an offensive degree. After they were forced to join Boston, the latter metropolis relieved the sewage congestion by means of a large intercepting trunk conduit.

Even where technological considerations are not primarily



responsible for annexation, great engineering benefits may spring out of such action. Thus, when Chicago took over Hyde Park, Lake, Lakeview, and Jefferson in 1889, it scrapped a large part of the local water-works equipment, unified mains, and linked the whole to the existing Chicago system. Important dividends in the form of increased efficiency may flow from the obliteration of local boundary mazes.

**Consolidation.** Consolidation, as exemplified by the history of New York City, offers another means of overcoming the hampering effects of local boundaries. The old metropolitan region of New York consisted of New York County, coterminus with the city of the same name, Kings County, coterminus with the city of Brooklyn, Queens County, comprising Long Island City and four towns, Bronx County, and Richmond County, the latter containing five towns together with a few incorporated villages. This maze of units interfered with the coördinated management of water-supply, transit, and other facilities throughout the entire district. Inasmuch as the several governments involved did not relish the thought of being summarily abolished through direct annexation to any one of their number, an alternative had to be devised. In seeking a solution to the dilemma, the state of New York hit upon a scheme for consolidating the affected sections into a brand new "City of New York." All the twenty odd entities within the limits of the novel creation were brought to an end; in their places were established five boroughs, each identical in its boundaries with one of the five original counties. To satisfy local pride, important technical duties, such as street paving and building inspection, were put into the hands of these subsidiary boroughs. The counties, of course, retained certain of their historic tasks. The benefits to be derived from centralization were secured through a compromise arrangement whereby the boroughs surrendered a number of powers, such as control over sani-

tation, to the main city authorities. Instead of being a homogeneous political community, New York City is a union of municipalities, with a complex division of work between central and local agencies. Under consolidations, it is evident, absorbed areas may lose considerably less of their identity than under annexations.

When a modern city expands to the borders of the county in which it is located, questions of duplication between the two political bodies inevitably arise. In an attempt to eliminate friction from this source, city-county mergers have sometimes been effected. Under the Maryland constitution, the City of Baltimore has been given legal status as a county, and now performs duties formerly vested in both county and city. On the Pacific Coast, the City and County of San Francisco have been consolidated; both are managed by substantially the same officers, serving in a dual capacity. After all, there is no valid reason why two governments, with identical boundaries, should be allowed to continue their separate existence indefinitely.

**Special Engineering Districts.** Drastic changes in boundaries, affecting every local governmental function, are not always warranted by surrounding circumstances. Where a number of municipalities possess a common interest in a single engineering enterprise, such as a water-supply system, no special advantage may be gained by going to the extreme of resorting to general annexation or consolidation in order to achieve united action. A simpler plan is to form a "special district" empowered to carry on the desired joint undertaking, with boundaries suited to the task at hand. Units of this type have been widely employed for many purposes, among which are water-supply, port services, sewerage, highway construction, bridge building, flood regulation, and fire protection.

Initial steps leading towards the establishment of a special district begin with the securing of formal authorization from the state for the contemplated move. After state

approval is obtained, the people of the area in question are consulted, as a rule. Sometimes, however, the inhabitants of the district have comparatively little to say in the matter; in the creation of the North Jersey Water Supply District favorable action by any one component municipality was legally sufficient to bring the whole entity into existence, regardless of dissenting sentiment in other portions of the same. At other times, the formation of districts is genuinely dependent upon local sentiments; an Illinois law allows sewerage districts to be laid out by popular vote. The ever-mounting number of special districts in the country seems to point to comparative ease in the creating process.

Characteristic of this general class is the Hudson River Regulating District of New York State, charged since 1922 with the control of destructive floods near the headwaters of the stream from which it takes its name. Formed at the will of its residents, under the terms of a state enabling act, the unit is engaged in the management of important facilities. The construction cost of its system of sixteen reservoirs, possessing a capacity of some 80,000,000,000 cubic feet, is estimated at \$30,000,000. The artificial basins thus created are expected to retain water at high stages, such as caused the 1913 flood which did physical damage to the extent of \$1,000,000 or more in three leading towns. Low flow, which ordinarily cuts hydro-electric power output and interferes with sanitation, will be increased by the release of impounded waters. The borders of the District, coinciding with the natural watershed under supervision, comprehend portions of twelve counties, the Adirondack State Park, and a number of towns and cities—a maze of political entities joined in a common task. In the aggregate, the works operated by the scores of existing special engineering districts in the United States constitute an encouraging display of coöperative ingenuity.

**Problems Involving Cities in Two or More States.** Methods of dealing with intercommunity problems, as outlined



above, are only applicable to cases in which the local governments involved are all in the same state. Different tactics must be employed when adjacent units lie in two or more states. Obviously Missouri can neither authorize nor command East St. Louis, Illinois, to coöperate with nearby St. Louis. Similarly Kansas City, Kansas, has no right either to annex, or to consolidate with, territory in Kansas City, Missouri, just across the line. Since special districts, too, are organized under the laws of individual states, they are also inhibited from cutting through state lines. Intercommunity relations, under these conditions, require the joint action of the interested states and often of Federal agencies in addition.

#### SHOULD THE AMERICAN SYSTEM OF JURISDICTIONS BE REVISED?

**Disadvantages of Present Arrangements.** In short, our survey of American political units has revealed a complex mass of entities—the nation, states, counties, townships, villages, boroughs, cities, territories, dependencies, and special districts. The government of each has certain powers of its own. These are not uniform throughout the land; the governments of cities and counties in one region possess different powers from those of cities and counties in another. Nor is the division of control among types of authorities clearly defined. The courts themselves are uncertain as to just where the rights of the Federal Government begin and those of the states end. Such a condition of affairs was not a very serious matter in the age of agriculture and isolated communities, which made up the background of our great American experiment. But today, when railroads, flood control, water-supplies, telephone, telegraph, pipe line and radio nets, and electric-transmission circuits draw together scattered sections, our historic system often operates inefficiently.

**Battle over Centralization.** Living and working in a system of political units not designed with reference to technological

requirements, we are naturally led to inquire what, if any, practical improvements might be made. Most prominent of all the proposals for shifts in the existing alignment are those embodying schemes for greater centralization. The process involves the removal of powers from a number of minor bodies and their concentration in the hands of a single large government. Thus the vesting of complete control over railways, intrastate as well as interstate, in Federal authorities, with a consequent elimination of state regulatory processes, would be a move towards centralization.

Our Federal plan of society has already undergone very important developments in this direction. The Constitution (p. 19), drafted in an agricultural age, vested only a few powers in national officers. With technical progress proceeding apace, these powers proved inadequate, and the courts provided an escape by "liberally" interpreting many phrases. Resorting to "broad construction," they sanctioned the use of the power to appropriate money as a tool to control major state highways (p. 39). Equally striking was judicial approval of the employment of taxation as a means of destroying poisonous phosphorus match industries in the United States. But there are limits beyond which even judges cannot stretch the Constitution. As a result advocates of extreme centralization propose a wholesale modification of our fundamental law to admit of a general expansion in national control commensurate with the revolution which technology has wrought in economy. Likewise, within the respective states, publicists are to be found suggesting a curtailment of city and county autonomy in favor of state management. Here alterations in state constitutions would often be necessary. Should such drastic steps be taken with reference to certain positive and practical ends?

There is no agreement on this point. Advocates of "state's rights" contend that we have already gone too far in the direction of centralization; they urge us to return at once to "the fundamental principles" of local autonomy laid

down by the founders of the Republic. Equally vehement, on the other side, are supporters of centralization who urge that existing Federal arrangements are antiquated and that a still greater concentration of power is imperative if modern industrial economy is to develop and function efficiently. Thousands of speeches and articles, pro and con, on the subject, have been published, making it one of the liveliest topics in current politics.

The engineer, who brings the cold and mathematical rationality of his science to bear upon the discussion of centralization *versus* local autonomy, is likely to be surprised at the heat and confusion of the dispute and the general absence of reference to concrete ends to be attained by the one policy or the other. He encounters such phrases as "the tyranny of centralization," "sacred rights of local self-government," and "the immortal principles of our fathers"—phrases which do not appear in engineering handbooks. So he is often tempted to throw up his hands in despair and to declare the whole business beyond his competence and interest.

Yet in practice—in constructing and managing public and private works of all kinds—he is constantly forced to meet this issue, to search for ways and means of accomplishing his ends amid the confusions of boundary and jurisdictional disputes. He must make suggestions as to the concrete requirements of his projects, considered as engineering designs intended to accomplish certain purposes without respect to geographical lines or the historic rights of persons and governmental authorities. It is important for him to face, therefore, the great dispute over centralization and local privileges.

At the beginning of an analysis of current arguments on the subject, a word of caution is in order. Concerns may find it to their advantage to join forces with one side or the other, helping themselves while ostensibly upholding "fundamental principles" of one kind or another. Where an organ-



ization fears Federal control, but finds state regulation impotent, it may uphold state's rights, and *vice versa*. William Jennings Bryan was very outspoken on this matter. "The railroads are for state's rights," he declared, "whenever they are fighting a Federal law, and for centralization whenever they are fighting a state law, but they are always, and in any case, for themselves." Again, during hearings on a proposed Federal child labor amendment, a representative of manufacturing bodies announced himself as a staunch supporter of state's rights. "It is not that we are opposed to the regulation of children in industry," he said, "but that we are opposed to the taking away of that subject by the Federal Government, as being another step in the centralization of power." While there are usually some "weighty arguments" on both sides, the engineer should always be on his guard against "good" reasons as distinguished from "real" reasons.

Now for the concrete claims of contending parties. Advocates of centralization urge that the adoption of their proposals is both necessary and inevitable. They point to vast organizations like General Motors, General Electric, Westinghouse, and the Radio Corporation of America, that are incorporated in but one state and operate in many. They refer to conflicts between Federal and state agents over the regulation of railroads as indicating the shortcomings of separate local control over operations that are related to, if not part of, a national system. Child labor in the factories of one region, competing with adult labor elsewhere, they urge, calls for country-wide rather than state or community action. Instances of the sort may be indefinitely multiplied. Hence they conclude: "We have traveled far from the days when the Constitution was written, so why not recognize the shift from isolated to integrated communities, by concentrating power over national problems in national hands?"

On the personal side, supporters of centralization sometimes maintain that, as a rule, a higher caliber of citizen is attracted to public office in the national government

than to positions in smaller units, such as states. They attribute this phenomenon to higher pay, greater prestige, and larger power attendant upon Federal service. Actually, it is difficult to weigh the merits of the claim. Petty minds and graft are not the monopolies of either state or national agents. In the absence of quantitative tabulations, therefore, we can do little more than mention the contention; we cannot affirm or deny it.

Opponents of centralization generally resort to tradition. They point to the fact that our form of government has not only successfully survived for a century and a half but also has been copied by other lands. This, they contend, is sufficient proof of the eternal wisdom of the founders of our country. Reverence for the past and distrust of the mentality of the people of today naturally lead to a conservative stand, a "safe" one. Is it not better to leave the existing order untouched than to try to improve upon it, with the danger that experimental meddling will make matters worse rather than better? This argument for local autonomy evokes widespread approval.

Seeking support for their position, conservative publicists point to unwieldiness as a potential fault in schemes for centralization. As matters now stand, the United States Government must itself discharge such duties as are vested in it. Only upon rare occasions, and then by subterfuge, can it throw on local units any of the burdens of detailed administration. Normally there are over 600,000 civil employees in the Federal service. If more powers are concentrated in national bureaus, under existing arrangements, the size and complexity of this huge organization must grow to a corresponding degree. Undoubtedly there is real danger in such expansion. Orders would have to pass through a longer chain of hands, resulting often in greater delay, expense, and possibilities of error. Chief officers would find it increasingly hard to keep track of the operations of their subordinates, especially in distant places. Routine regula-

tions would have to be drawn up by the hundreds to smooth the path of action and prevent conflicting decisions. Such a course would play havoc with originality, initiative, and the sense of personal responsibility. The same evils would arise, though on a smaller scale, in connection with the shifting of city or county functions to state bodies.

By way of contrast, small governments are much easier to manage. Papers travel a shorter distance, passing through fewer hands. Red-tape, expense, and the possibility of errors are reduced. A mayor directing a few hundred men or a governor with a few thousand subordinates is in a position to exercise closer supervision over his charges than a President with a half million persons under him. Consequently, there is less necessity for routine, more room for attempting fundamental experiments in action.

This statement is more than pure theory; it is borne out in practice. Time and again important movements have had their inception in the efforts of minor bodies. Ideas tried out on a small scale spread from place to place until, gaining momentum, they finally win general recognition. Railroad history is a case in point, for it was pioneering work on the part of the states that opened the way for ultimate Federal regulation. There does seem to be a critical point, then, at which the mounting size of a unit renders it so unwieldy as to cancel many of the advantages that would otherwise accrue from centralization.

From issues of efficiency the debate over centralization *versus* local autonomy passes to a consideration of democratic institutions. Representatives elected by and operating within a restricted area, it is said, become closely acquainted with the needs of their communities and are therefore in a better position to apply remedies than officers hundreds of miles away. Voters, for their part, are more apt to take a lively interest in public affairs when dealing with matters close at home than when attempting to solve problems for a distant capital. Furthermore, the individual may more readily



make his weight felt when one of a few hundred or a few thousand enfranchised citizens in a community, city, or state than when a mere head among many millions in a nation. Going to the polls seems less futile, when the voter is a big frog in a little pond than when he is a small frog in a huge lake. For such reasons writers urge the preservation of local autonomy as an aid to the vigorous functioning of democracy, assuming the latter to be a better criterion than efficiency in public and private enterprise for deciding the controversy.

Here the issue turns upon moral or human values as contrasted with the rationality and efficiency of engineering; and the science of technology, as such, is incompetent to pass judgment. When the engineer points out that a collection of communities or states could have a more efficient and less expensive system of water-supply, sewerage, sanitation, transportation, or communication by effecting a consolidation of powers, and the advocate of democratic self-government replies that he prefers inefficiency and waste to the loss of local rights, technology can furnish no superior court to settle the contest. However, the experience of other countries may throw light on the possibilities of making compromises that are adapted to technological inventions and methods.

**Swiss Federalism.** There are, for example, other types of federal government that provide for a high degree of concentrated power while at the same time escaping many of the evils of unwieldiness. Although the Swiss government possesses broad authority over national affairs, its official personnel is remarkably small in size in proportion to the total population. The explanation is simple. National officials serve as a kind of general planning staff, preparing policies, making laws. Instead of employing a great federal army of subordinates to enforce measures, Switzerland assigns this task mainly to local entities known as cantons. The latter have the dual obligation of managing their own

affairs in their own way and of serving as administrative agents of the nation. Both the central and local governments remain flexible, securing the benefits of unified action without the difficulties usually attendant upon a centralized system of organization.

Application of the same principle in the United States might serve to smooth away many of the conflicts between engineering requirements and practices of local self-government. Already possibilities in this regard have been explored in connection with the management of Federal-aid highways. As explained above (p. 39), a small staff at Washington, D. C., prepares standards for the major roads, inducing the states to carry them out by offering financial assistance. The general adoption of the Swiss expedient, however, would require sweeping changes in our Federal Constitution, forcing states to serve as administrative agents of the national government, and, if deemed desirable, this is not likely to occur, at least in the immediate future.

**French Unitary Plan.** In contrast with any form of federal centralization is the "unitary" plan of government. The latter is to be found in full running order in France. There minor political units are allowed but little freedom to do as they please; generally they must obey orders dispatched to them from key offices in Paris. If one of the latter, under general law, works out a broad sanitary or highway program, it has only to command regional bodies to comply with its orders to put them into effect. Local governments, in other words, are convenient tools for the execution of the national will, rather than autonomous entities. Consequently the great profusion of local policies to be found in the United States is absent. Being under one supreme command, French districts were organized on a simple basis to admit of the rapid transfer of ideas. The country was laid out into eighty-nine *departments*, each directly responsible in certain matters to the major heads in the national administration. Directions received by *departments* are distributed among smaller

suborganizations known as *arrondissements*, of which there are 276. The *arrondissements* in turn relay matters to 37,000 municipalities, known as *communes*. Such an arrangement represents the ultimate in centralization.

America is many times the size of France. Whether a unitary arrangement would work satisfactorily in this country remains problematical, for it has never been tried on anything like as extensive a scale. The only phase of our political system which resembles that of France is the district organization to be found in certain Federal and state services. Our government lighthouses and other aids to navigation, for example, are distributed along thousands of miles of seacoast and airways. To direct these scattered enterprises, the nation has been laid out in a series of subdivisions. Each of the latter has its own staff and is in close touch with local peculiarities. While given a measure of free play in fitting standards to special needs, each district is required to conform with general rules for the entire service, prepared by authorities in Washington, D. C. Orders emanate from the center and are carried out by separate bodies, somewhat after the French plan. A similar device has been evolved for the management of river and harbor improvements, through the laying out of engineering districts. Federal Reserve Districts, set up for the administration of banking laws, afford a third example of the process. While these districts generally disregard state lines, nevertheless it is conceivable that they might be revised so as to become coterminous with states, permitting a gradual transition towards unitary control. An extreme outcome is, however, so far removed from the realm of practical politics today as to be little more than a suggestion for thought.

**Problems Not Easily Solved.** How will the conflict between technology and the existing system of jurisdictions at last be resolved? Perhaps never to the final satisfaction of all parties. Nor does there appear to be any way of forecasting immediate outcomes. It seems certain that tech-



nology will continue to cut through geographical and legal boundaries. Technology is universal, not national or local or provincial, in the objects of its interest—the materials and forces of nature in use, and in its method of thought it is rational and mathematical. Nature's laws operate as infallibly in one portion of the United States or the world as in another. Radio stations follow the same principles in Connecticut as in California. Motors in transcontinental buses operate on the same principles in the mining regions of Pennsylvania as on the Western plains. Engineering will continue to uphold rationality and efficiency as its supreme ends in the public and private enterprises which it undertakes. And people will continue to demand the services which it alone can render. This much appears to be certain.

Yet this onward march of technology across geographical and jurisdictional boundaries will continue to be resisted in the name of local democracy and special interest, public and private. The area and intensity of this conflict will doubtless increase rather than diminish. There will be friction and waste of time. There will be adjustments, compromises, and probably bold experiments in legal and political invention.

The engineer will be more and more involved in the contest, for these political forces, though different from nature's forces, are very real and may find expression in the physical power of the police and the army. He cannot ignore them in planning and executing technological enterprises, public and private. Conceivably, however, he might contribute to the solution of boundary and jurisdictional problems by disassociating himself from ancient disputes full of passion and political morality and by approaching the issues from the standpoint of his science—rationality and efficiency. By making clear in each case the technological ends to be attained and the means best adapted to realizing them with the least expenditure of energy and materials, he could help to create a saner public opinion.

**Effect of National Planning Acts on Jurisdictional Boundaries.** That the whole subject of boundaries and jurisdictions will have to receive a new consideration is made evident by the changes introduced into agriculture and industry by the emergency legislation of 1933 (below, Chapter XVIII). Under that legislation the Federal Government is undertaking functions once supposed to belong exclusively to state and local government—hydro-electric development, homestead building, direct employment relief, and grants to local housing corporations for the eradication of slums. Under the National Industrial Recovery Act and the Agricultural Adjustment Act, it is reaching down into industry and agriculture, organizing them and controlling them in ways entirely apart from the regulation of interstate and foreign commerce contemplated in the Constitution. At the same time, the Federal Government is financing state and local governments in public-works construction and unemployment relief and establishing controls over their expenditures and devices. In organizing its new functions, the Federal Government is ignoring state boundaries, cutting across them, and dealing directly with local areas. If this continues on a large scale, the old debates about state's rights, local autonomy, home rule, and so forth will soon appear to be historical curiosities. And the movement is likely to continue. Technology was destroying territorial and jurisdictional boundaries long before the crisis that opened in 1929, and necessary adjustments of government to its inexorable development cannot fail to alter ideas and practices that originated in days of the ox cart and sailing ship.

**Public Corporations and Jurisdictional Boundaries.** Another striking development of recent times which may offer an effective solution of many boundary problems is the creation of public corporations, national and state, for the discharge of certain functions. The Federal barge corporation engaged in operating vessels in inland waters is a noteworthy example. The livestock credit corporation,

regional agricultural credit corporations, and the commodity credit corporation also give indications of possibilities. A public corporation is a creature of government and it may be employed for almost any purpose of public interest. It may build houses, operate plants, engage in transportation, and exercise large powers without reference to specific state and local boundaries. Conceivably the entire transportation system of the United States might be managed by a single corporation, in which the Government of the United States might own all or little of the stock; and such a corporation could be emancipated from the vast and confused body of state and local laws bearing on the subject. This could be done without altering any boundaries or the Constitution of the United States or the constitutions of any states. In this way the central engineering plans of the national transportation staff could cut through opposition and contradictions to the single end of securing efficient and coördinated transportation throughout the country. Evidently, then, experimentation in overcoming boundary barriers standing in the way of the efficient functioning of technological enterprises is beginning. In time the whole tangle inherited from the pre-technological age may be swept away, so far as great branches of national banking and economy are concerned.



## CHAPTER III

### POPULAR CONTROL IN A TECHNOLOGICAL SOCIETY

In carrying on his operations within and across boundaries and jurisdictions, as indicated in the previous chapter, the engineer comes into contact with agencies of government at innumerable points and is compelled to obey them or make adjustments with them. These agencies possess power—ultimately the power of the police and armies—to compel obedience to their orders. But these agencies are not mere arbitrary bodies engaged in making and executing orders. Behind them is another power—popular opinion and will, expressed periodically in elections and more or less continuously in pressures on the government. Hence, the engineer, in trying to find his place and way, in proposing and carrying out projects, is brought face to face with this force of popular will and opinion. Unlike the political scientist, he may not be interested at all in the phenomenon for its own sake, but he has to wrestle with it practically and must give thought to it, if he is to become more than a routineer in his profession.

Our form of government is a democracy in which “the will of the people” theoretically predominates. The Declaration of Independence stated this fundamental doctrine in no uncertain terms. Governments, it announced, derive “their just powers from the consent of the governed,” and “it is the right of the people to alter or abolish” any political institutions that restrain liberty, introducing in their place new institutions. The historic tradition has never died. Today the citizen possesses significant privileges of direct and indirect control over the forms and functions

of government, privileges which he frequently exercises through the medium of the ballot. Engineers, then, in dealing with Federal, state, or local authorities must inevitably reckon with "the man in the street" who shares in public enterprises through his decisions at the polls.

### FORMS OF POPULAR CONTROL

**Political Parties.** Individually, the voter is quite helpless. If he would count in the governmental field, he must join with other citizens in some formal organization. Such an organization is the political party. At the center of this combination are persons intent on bending government to their purposes or winning favors at its hands, and persons in quest of position or fame, all united in a common drive. Expressing the motivating interests are armies of workers, employed in canvassing homes, delivering speeches, arranging parades, putting up posters, distributing pamphlets, and generally "lining up" the public. Gravitating towards the party nucleus are men and women eager to use the association as a means of making valuable business or social acquaintances. Moreover there are the loyal "boosters" who support the organization in methodical fashion at the polls. Besides being an agency for doing political work, the party, then, is a club. Drawing strength from the broad mass of voters, the victorious political party is able to write its policies, if it has any, into law and to secure their enforcement.

The United States is essentially a two-party country, the contest between Republicans and Democrats forming the chief interest of our politics. Each group is supposed to advocate particular policies of its own, offering to put them into effect nationally or locally whenever granted a majority at the polls. Yet clear-cut divisions between these parties on vital issues are rare, since neither organization wishes to run the risk of making enemies or incurring defeat when the actual trend of public opinion is unknown. For this

reason, small, independent parties spring up from time to time, fearlessly declaring creeds not recognized by the major parties, realizing that their strength is slight anyway and that their main concern is propaganda.

Generally speaking, these smaller groups count for little, except in registering a protest and in creating public opinion. Of course there are exceptions. When the outcome is close, the diversion of a few ballots to some new group may turn the scales from one major party to the other. Claims have been made that the swing of Republicans to the Prohibition Party in 1884 was just enough to enable the Democrats to triumph in New York State, thereby barely carrying the nation for Grover Cleveland. While feats of this character are rare, the potential danger remains, often inducing major parties to bargain with these minor groups, accepting their ideas to a limited degree in order to secure extra support. The infiltration of policies into government through this channel is astonishingly large. Still more significant, perhaps, are factional struggles within the regular ranks. As the presidential election of 1912 approached, for example, the Republicans divided into the Republicans and the Progressives. Quarreling among themselves, both lost, making possible the victory of the Democrats. Thus, both minority parties and factions within the two major parties must be taken into account in exploring the forces of politics which move government.

**Party Promises.** Operating under the shadow of the party system, voters exercise their legal power of control over government. One of the oldest and most important of their duties is to select representatives whose views on important topics they regard as "sound," or "satisfactory." Legislators, administrators, and even judges in some states stand for election. When running for office, they issue statements in which they give clues to the types of measures they will support if they win. Thus, in a race for positions in the Federal Congress, during the campaign of 1932, California



party nominees made a series of promises to secure popular support. Among the engineering items endorsed by the several contestants were adequate aerial defense for the vulnerable California coast, the conservation of natural resources, Federal aid for flood control and water-supply in the southern portion of the state, and national public-works construction for unemployment relief. By choosing persons favorably inclined to their several schemes, citizens may exert a marked effect on the annual crop of statutes and ordinances.

Unfortunately, however, it is often very difficult to tell just what the pledges of the candidates really are in substance. To avoid making enemies, rivals may attempt to straddle all pressing issues, so that their evasive promises and answers render it impossible to discover what they actually intend to do. The directive strength of the voter is slight indeed in these circumstances. Furthermore, the candidate, of course, is under no legal obligation to abide by his platform if elected; moral duty to his constituents and fear of defeat at the next election are the chief forces holding him to his original pronouncements.

**Nomination of Candidates.** Generally the number of aspirants for important posts is so great that the process of choice cannot be carried out at a single election. Consequently, it is customary to break the process up into two stages—nominative and elective. In the former, minor men are eliminated, narrowing down the field to two or more leaders for each office to be filled. Historically, political parties performed this preliminary task themselves, by holding party caucuses or conventions for the several offices in question. And today the Republicans, Democrats, and minor parties hold national conventions every four years at which candidates for President and Vice-President of the United States are picked. Party delegates from all over the country appear at these assemblies, present the names of their favorites, and vote again and again until an aspirant

for each of the two offices musters enough support to win the nomination. In some states and localities the party convention is still employed to make nominations for state and local offices.

Obviously the average citizen, too busy with his private affairs to take part in caucuses and conventions, is shut out of the nominating process under the historic arrangements just described. Seeking to extend popular sway even into the initial stage of nomination, staunch advocates of democracy finally induced state and local governments, in most cases, to abolish the party convention as a nominating agency and to substitute for it the "direct primary."

A direct primary is, as a rule, an election within each party at which party voters can express their preferences with respect to the party aspirants to be named as candidates at the ensuing election. In a few places the elector is permitted to vote freely in the primary of any party; elsewhere he must prove his allegiance before being allowed to vote in the primary of a party. The latter check prevents members of one group from trying to weaken their rivals by helping to force the nomination of inferior candidates on the opposition. Where a political party is so strong as to be sure of the election, for example the Democrats in the Far South, the battle in the primary is naturally more significant than the election itself.

Still another plan of nomination, especially for local elections, is the non-partisan primary. Where this is in force, aspirants for nomination file their names with the specified government agents, together with supporting petitions bearing a requisite number of signatures. Those complying with legal formalities are then placed on the primary ballot and nominees are picked by popular vote; thus, theoretically, aspirants for office have an equal chance.

**Election of Candidates.** After the primaries, candidates are given a period in which to rally their forces and campaign for popular support. At the close of this interval, the regular

general elections are held. Many citizens vote a "straight ticket;" that is they express themselves in favor of all the nominees offered by one party. Others split their choices between rival organizations, checking the names of men deemed most worthy, regardless of their party affiliations. After the polling booths are closed, the votes are counted, and ordinarily the person having a plurality is declared to be elected.

Difficulties arise in this connection. Let us suppose that four men are running for a position, the total poll being 100,000, of which A receives 38,000, B obtains 32,000, C 27,000, and D 3,000. It is apparent that the victor, A, is far short of having a majority of all the votes. What would have happened if C and D had not been in the race is problematical; perhaps B would have conquered A. This outcome of the plurality rule has led a few states to introduce in local elections a preferential system in which the voter may vote for three or more candidates indicating the strength of his preference by marking the names "first choice," "second choice," and so forth. If one candidate receives a majority of first choices, he is elected. If not, the candidates low in the scale of votes are eliminated, the second choices of their supporters are examined, and, by various methods of calculating, a candidate preferred by the voters is declared victorious.

**Recall of Public Officers.** In several states, as well as in many units of local government, an elective officer or legislator, once seated, may be removed by means of the recall. The process is briefly as follows. A group of citizens grow dissatisfied with the policies of a given office-holder. After the elapse of a statutory period, they circulate a petition setting forth their grievances. When the number of signatures reaches the legal minimum, the necessary papers are sent to the proper official who checks them for fraud. After such preliminaries are completed, the accused person is granted an opportunity to resign and, if he does, his place is filled



by appointment or by the alternative means of an election. Usually, however, he chooses to defend himself instead. If the latter course is taken, a new contest opens. At the polls, the man under fire runs against a field of rivals, the voters deciding whether the present incumbent or someone else is better suited for the post in question. Democracy, it is maintained, thus has a check on the actions of the officer or legislator who ceases at any time truly to reflect the opinion of the voters who elected him.

**The Referendum Process.** Not content with indirect control over legislation, through election or recall, spokesmen for democracy agitated for direct popular control over law-making itself. To accomplish this purpose, two devices have been adopted in several states and many municipalities—the “initiative” and the “referendum.” As its name implies, the referendum is a device whereby the various types of measures may be taken out of the hands of the normal law-making assembly and referred to the voters for their approval or rejection. Often the operation is compulsory, for certain types of acts cannot become effective until referred to and definitely approved by the voters. Thus the dangers inherent in allowing elected representatives to spend public funds freely on costly construction or to grant valuable franchises to utilities have driven many states and localities to seek the democratic safeguards of the referendum. Consequently the fate of large bond issues or important franchises is commonly vested in the voters, under mandatory requirements.

Even though the law does not compel the reference of a given legislative measure to the voters, the latter may, where an initiative-referendum system prevails, obtain a referendum by formally requesting the same. Any citizen displeased with a specific bill may start proceedings against it by circulating a petition demanding a popular test of the legislation at the polls. A certain number of signatures must be affixed to this document before it becomes effective—

states require the names of from five per cent to ten per cent of the voters; cities may ask for as high as fifteen per cent. If the list of petitioners reaches or exceeds the legal limit, it is turned over to the proper official who then checks it for possible frauds. When all the requirements governing the preparation of the petition are met, new wheels are set in motion. The government officer in charge calls for balloting to decide the fate of the contested item. If the measure at stake is of pressing importance, it may be submitted at a special election; if it is of minor significance, the polling may be put off until the next general election, a year or so away.

**Referendum Delays.** Completion of the optional referendum process consumes a good deal of time. Ordinarily bills are "dead" for the entire interval. Where the system is in force, it is usually specified that ordinary laws shall not take effect for a month or two after passage by the legislative body. Petitions for a vote, when filed during this probationary period, have the effect of holding the act in abeyance until the subsequent election determines its fate. Temporary cancellation of a measure for a year or two, by such means, has often proved profitable to organized groups. Thus utility concerns have occasionally exercised their legal right of petition for the purpose of postponing the enforcement of an adverse regulation as long as possible. Even if defeated in the final balloting, they have won a breathing spell.

Sometimes the safeguarding of public health or safety, indeed the very continuance of the government itself, necessitates rapid moves. Upon such occasions a year or two of delay in the enforcement of important policies, pending popular approval, becomes a serious matter. Recognizing this problem of urgency, states and localities sometimes make the referendum process inapplicable to all "emergency" measures. Here, however, legislators are tempted to abuse their privilege by classifying as emergency acts measures that should not be so labeled. In South Dakota, during the twelve

years subsequent to the adoption of the optional referendum, 1251 acts were passed, of which 537 were declared to be urgent, that is, beyond citizen interference. But rather than run the risk of having the sphere of democratic control narrowed down in such a drastic manner, some states and municipalities permit emergency laws to be carried out at once, subject to subsequent cancellation at the polls. A second alternative is to allow referenda to be held on all bills, trusting that the evils of lost motion will be minimized by hurried calls for special elections whenever exigencies demand immediate consideration. The time factor, then, enters into popular as well as legislative law-making (p. 130).

**Extended Use of the Referendum.** Wide indeed are the applications of the referendum. True, the national Government has not yet seen fit to utilize the process. But forty-seven states apply the method to constitutional amendments, while twenty extend it to cover statutes. Counties also resort to popular balloting. To this list must be added cities, a large number of which employ the referendum as a means of checking changes in municipal charters or ordinances. From 1919 to 1925 inclusive, over 600 constitutional amendments were submitted to general vote, while between 1904 and 1925 inclusive, 173 referenda on state laws were taken. The returns for cities, if available, would materially augment the total.

What is the practical effect of all this procedure upon the work of the engineer? Frequently he cannot turn a shovelful of earth on a public or private enterprise until permitted to do so by popular approval of measures granting the necessary funds or the legal authority to realize the objective. Thus in 1907 the citizens of Los Angeles approved on a referendum the issuance of \$23,000,000 in bonds to pay for building the Owens River Aqueduct. Referenda taken in 1908, 1910, 1924, and 1928 furnished to the technicians in charge of the San Francisco Hetch-Hetchy water-supply \$80,000,000 with which to go ahead. Residents of



Detroit voted \$15,000,000 in bonds, in 1920, for the construction of 100 miles of municipal street railway and the purchase of thirty-four miles of private lines. Later, in 1922, a second poll set aside \$19,850,000 more to permit the city to take over the Detroit United Railway. The enlargement of the Erie Canal, in New York State, to the tune of \$101,000,000, was the result of a favorable referendum. So, too, the issuing of \$220,000,000 worth of bonds for the Colorado River Aqueduct of the Metropolitan Water District of Southern California was authorized by a referendum. Technical men lean heavily on the public for support.

**The Initiative Process.** The referendum permits the people to cancel portions of the work of legislative bodies but it does not enable citizens to suggest action themselves. Feeling that voters should be allowed to formulate as well as veto bills, reformers have devised the initiative. Whenever any group in a state or community possessing the initiative system finds it impossible to force a desired policy through the regular legislative channels, it may draft a remedial act of its own. As in the case of referenda, a canvass is next made for signatures in support of the proposed plan. The number of names required to make the petition effective varies widely; it may run from five per cent to twenty-five per cent of the whole electorate. Legal specifications being met, the document is submitted to the proper official who checks it for frauds and if he finds that it complies with the law, he so certifies. In some cases it is then automatically laid before the voters for action. In other cases, legislators are given an opportunity to adopt or reject the proposal. If the bill is approved without change, the goal of the initiative petitioners is at once achieved. If it is rejected, the measure is thereupon submitted to the voters for judgment. Although legislatures cannot reword bills, they may, in certain jurisdictions, suggest an alternative, presenting both the initiated and the revised schemes for simultaneous

public review. The majority, as prescribed by law, on election day determines their fate.

Defeated measures are not necessarily buried for all time. History reveals numerous cases where bills, once snowed under, are revived again and again until, with a change in public opinion, they are victorious. Many localities permit free play in this regard, placing no restrictions on the resubmission of questions. Others, recognizing that it takes an appreciable interval of time for popular views to change, seek to prevent the overburdening of ballots with too frequent repetitions. Consequently they provide that bills failing to pass on one occasion shall not be presented to the voters again until the close of a specified period; Nebraska has fixed it at three years. Slow swings in sentiment are thus given play.

Statutes and ordinances, once approved by the voters at the polls, are usually on the same unstable footing as other laws; legislative assemblies may alter or repeal them at will. Practically speaking, however, legislators do not often take advantage of their acknowledged rights in the matter. The reason is simple. If they should fly in the face of public opinion, as recorded in referendum decisions, they would run the risk of losing their seats at the next election of representatives. Going beyond this extra-legal safeguard, a few localities have provided that legislative bodies cannot repeal bills adopted by popular acclaim, even if they wish to defy the will of the masses. Thus Arizona, in 1914, exempted acts passed by the people from legislative interference. A few city charters follow the same path, placing restrictions on the legislative annulment of ordinances put on the books by referendum vote.

**Extended Use of the Initiative.** Extensive use is made of the initiative. The Federal Government does not employ the system, but many states, counties, and cities do. Constitutional amendments may be popularly suggested in thirteen states while statutes may be initiated in eighteen. A

number of municipalities employ the method for the proposal of charters and ordinances. Active use of the scheme is revealed by figures. From 1904 to the beginning of 1926, 214 constitutional amendments and 226 statutes were initiated. Corresponding information for cities is not available.

Engineers, along with other citizens, are affected by this general resort to the initiative. A recent Nebraska case is illustrative. The state is sparsely populated, only a third of the inhabitants living in places of 2,500 or more. Naturally, electric-transmission costs are unusually heavy, necessitating high rates for current. Seeking to hold charges down to a minimum level, almost 200 cities, towns, and villages within the state installed municipal electric systems. These works were hampered by a state law forbidding them to extend wires beyond the boundaries of the political unit in which they were located, effectually preventing adjacent sections from securing government service. The League of Nebraska Municipalities, the League of Women Voters, and other organizations tried to induce the state legislature to put through remedial measures. The result was absolute failure. Intent on getting relief, these groups next decided to experiment with the initiative. A bill was carefully prepared, allowing each government plant to build its lines into territory outside of the local limits, which it might wish to tap. Despite opposition from private concerns wishing to forestall unfavorable competition in rural areas, 55,000 citizens signed a petition in support of the act. The signatures being sufficient to put official wheels in motion, the measure was duly submitted to popular vote and was adopted, giving municipal engineers room for extending the government service.

**Some Practical Examples.** Although effort has been made to illuminate the above brief description of political machinery, for the engineer, by citing certain technological illustrations, the process may still seem remote from his actual interests. This apparent remoteness may be partly offset and the business brought to concrete cases by the



following list of measures submitted, among others, to the voters of the several states *in a single year* (1926):

- Adding meat inspection amendment to livestock code
- Authorizing taxes and \$10,000,000 bond issue for highway purposes
- Creating motor vehicle department and providing for automobile tax reduction
- Exempting new cotton mills from taxation for seven years
- Empowering first and second class cities to issue municipal improvement bonds
- Repealing law providing for full crews on railroad trains
- Levying gross receipts tax for highway purposes on motor transportation companies
- Changing state tax on short line steam railroads
- Validating \$8,500,000 bond issue for state buildings and university buildings
- Exempting reforested young timber from taxation
- Increasing powers of irrigation districts and authorizing temporary transfer of funds
- Classifying highways as primary and secondary and appropriating \$5,000,000 annually for twelve years for highway construction
- Creating state board to develop water-power sources and authorizing bond issue of \$500,000,000
- Further regulating the manufacture and sale of oleomargarine and imposing a tax of two cents a pound thereon
- Increasing gasoline tax from two to three cents per gallon
- Authorizing legislature to levy motor vehicle registration license fees in lieu of ad valorem taxation
- Creating a public utilities commission and defining its powers
- Amending laws relating to dentistry and permitting dentists licensed in other states to practice without state examination
- Providing revenue for highway purposes by levying new scale of motor vehicle licenses and gasoline tax
- Authorizing county to increase bonded debt for hydro-electric purposes
- Authorizing legislature to tax for state highway purposes
- Authorizing county to issue road bonds
- Authorizing lease of a portion of a canal

- Fixing severance tax in reforestation contracts and validating legislation on that subject
- Relating to parishes, road districts, and municipalities contributing to cost of bridges across navigable streams
- Permitting formation of irrigation districts and limiting indebtedness which may be incurred by subdivisions
- Increasing motor vehicle and gasoline taxes for highway purposes
- Extending time for construction of a combined system of irrigation, navigation, and hydro-electric development
- Relating to construction of sea wall
- Authorizing legislature by general law to provide for metropolitan districts to supply certain services
- Authorizing legislature to extend to municipalities the power of excess condemnation
- Extending authority of municipalities to levy special assessments
- Relating to tax rates upon crude oil, natural gas, asphalt, lead, zinc, and other ores
- Imposing taxes for highway purposes on common carrier motor buses and trucks
- Imposing bus and truck operating licenses for highway purposes
- Creating water and power board and authorizing bond issues not to exceed 5 per cent of assessed valuation of state
- Authorizing \$3,000,000 bond issue for bridge construction
- Authorizing \$500,000 bond issue for bridge construction
- Authorizing \$1,125,000 bond issue for new buildings at penal and charitable institutions
- Authorizing certain counties to exempt cotton and textile enterprises from county taxes for five years
- Authorizing certain counties to exempt manufactures from county tax for five years
- Authorizing certain counties to exempt furniture factories, pulp and paper mills, and cigarette and tobacco factories from county tax for five years
- Declaring a river non-navigable and exempting it from constitutional provisions relating to navigable streams
- Relating to reforestation and authorizing legislature to levy a special tax on forest lands.

## THE SUFFRAGE

**Extent of the Suffrage.** The voters, who wield important powers over legislation, constitute only a part of the total population. Although detailed restrictions on the suffrage vary in different portions of the country, certain rules are rather uniformly applied. First of all, the ballot is never entrusted to minors under twenty-one years of age. Although the specific point of twenty-one has no strictly logical basis, the propriety of excluding immaturity is readily apparent. Secondly, aliens, because they owe no permanent allegiance to the United States and therefore have no perpetual stake in the nation, are not enfranchised. Thirdly, residence for a statutory period, ranging from a few months to a year or two, in the state and locality in which the individual wishes to vote, is commonly prescribed. The latter proviso prevents the packing of the polls by swarms of outsiders, imported for the occasion by parties interested in overwhelming the "native" element.

The remaining restrictions are miscellaneous in character. In a number of states illiterates, as discovered by prescribed tests, are deprived of the ballot. Criminals, the insane, and paupers living on public charity are likewise kept from the polls. Sometimes tax and property-holding qualifications are placed on the suffrage. Ostensibly this is done on the ground that persons paying little or nothing in the way of taxes or possessing no property have no direct interest in the efficient conduct of public affairs. More or less openly, the Negro, too, is commonly discriminated against by various ingenious devices, especially in the Far South.

Detailed suffrage qualifications of this character make some method of checking imperative if frauds at the polls are to be prevented. Control is exercised, as a rule, by means of a system of registration. Generally, each individual is required to appear before the proper government agents for examination, at a specified time and place. Here he submits evidence



of his right to vote. In the interval that elapses between registration day and election day, the correctness of the registration list may be verified by duly authorized inspectors. Anyone who fails to register in time or makes false claims as to his qualifications is excluded from the polls; registration, then, operates as a type of extra limitation on the exercise of the franchise. The process must ordinarily be repeated before each election, although a few localities now arrange for permanent recording, granting a continuing privilege of voting so long as the status of the individual remains unchanged.

**Non-Voting.** Engineers concerned with securing popular support for favorable legislation on election day ordinarily need pay attention to only a fraction of the total population, especially in local jurisdictions. Doctor William Anderson estimates roughly that only a quarter of the inhabitants of an average city are qualified to exercise the franchise. State statistics show that, in Arizona, California, Connecticut, Indiana, New Hampshire, New Jersey, New York, and Oregon in 1920, between 66 per cent and 86 per cent of the *adults* were registered voters. Besides, many actual registrants fail afterwards to express their opinions at the polls, further restricting the number of ballots cast. The extent of such indifference depends, of course, upon the appeal of the measure at stake.

Two fairly typical cases serve as illustrations. When a state law relating to the famous Moffat Tunnel was referred to the people of Colorado in 1912, only fifty-two per cent of the 266,000 voters who cast ballots for President of the United States paid any attention to the engineering project, though it was submitted at the same election. In a Denver city election of 1913, with a potential registration of around 70,000, only 30,000 persons took the trouble to vote on a pending telephone ordinance. Obviously, the "will of the people" is often not the will of "the whole people."

"Minority" rule is a constant danger. There are several

reasons for non-voting. Bad weather on election day may effectively serve to reduce the ardor of citizens. Confidence in the overwhelming victory of their side may lead individuals to feel that it is quite unnecessary for them to waste time swelling the totals. Others, failing to comprehend the issues at stake, see no reason for voting one way or the other. Indifferent citizens, shunning burdens for which they receive no direct compensation, stay at home. Even many interested electors are genuinely discouraged about democracy; how can their single votes, buried under an avalanche of thousands or millions, really be of value in determining the outcome? Why bother to cast a ballot?

For various causes, therefore, on ordinary occasions only a fraction of the eligible voters actually expresses an opinion on election day. While it is hard to tell whether those that do vote are representative of the entire electorate, there have been instances in which it is at least probable that the returns are not typical. A special group, interested in carrying or defeating a bill, may take advantage of the negligent. Marshaling an active minority and gathering in force on the scene of action, it may make a clean sweep of things, the opposition losing by default.

**Ballot Frauds.** According to law, an honest and efficient record must be made of the polling that does take place on election day. Two systems are in vogue. The oldest and most common employs paper ballots, on which decisions are registered by means of crosses. This method has several disadvantages. A mistake in marking a ballot automatically renders it void, utterly throwing away the voter's influence on the final results. A student of the subject has found thirteen incorrect ways of placing checks on a specific ballot and forty-four errors in the style of marks, any one of which is sufficient to make it invalid.

When the ballots ultimately reach the officials in charge of counting the votes, still worse things may happen. Writing of conditions in Indiana at a particular election, an informer

declares that the entire contents of a ballot box were dumped and burned and that other more "suitable" ballots were put in the place of the unwanted papers. After the 1920 elections in New York City, a large number of ballots was carried off in bulk; some of the missing papers were subsequently located at the edge of a sewer-opening where others had doubtless been disposed of. In a Chicago election, the officers of a certain district counted one bundle of 100 ballots and estimated from the resulting average the total return for the district. In a second district they divided the "yes" and "no" returns into two piles and based their "count" on the height of the stacks. In still a third precinct they carefully studied the vote on the first of several referendum measures and arbitrarily assumed that on each of the remaining items the same percentage of "yes" and "no" votes had been cast. In unscrupulous or careless hands, the paper ballot may be a device which fails to secure an accurate expression of popular will.

The influence of illegitimate practices on final results is revealed by a set of statistics from Chicago. A private recount was made of the referendum ballots from 56 out of 2,300 precincts, covering the election of November, 1926. The survey showed that while the reported percentage of voters in favor of a road-bond issue was 59.0, the actual figure was 50.5, very close indeed to the border between success and failure. What would have been discovered if the remaining precincts had been examined is a question. Disclosures of this nature are responsible for frequent election disputes and the transfer of issues to the courts for settlement. A great deal of time and money has been spent in litigation to determine the true fate of important measures.

**Voting Machines.** Difficulties with the paper ballot finally led to the invention of the "voting machine." Where this mechanical device is employed, each individual, in his turn, manipulates a set of levers, according to his views, and his opinions are automatically registered on indicators. The



process has much to recommend it. In the first place, frauds are rendered more difficult. Although the day's totals may be read through a glass window, the recording mechanism can be kept securely locked in a metal case and mischievous meddling with it prevented.

To the advantages of honesty offered by the voting machine must be added those of accuracy; human errors likely to creep into the counting of paper ballots are, of course, excluded. Then, too, it is difficult for the operator to make a mistake that will throw out his decision. Void votes are thus largely eliminated, insuring more representative results. Speed enters as still another factor. As each person expresses his will, his action is automatically added to those of all his predecessors. Consequently, the moment the polls close, the grand summation is already visible on the wheels. Where this method is used, newspapers containing the election returns for an entire city may be printed and on the street within less than an hour after the booths are closed. Speed and accuracy go far towards obviating the contests over votes which so often occur under the paper ballot plan. So the engineer, by inventing the voting machine, has performed a notable service to the public. Recognition of the merits of the device is to be found in increasing adoptions.

## THE NATURE OF POPULAR CONTROL

**Importance of Democracy to the Engineer.** Such in summary are the institutions and devices through which popular control over government is exercised in the United States. In final analysis, all law-making and administrative authorities with whom the engineer comes in contact derive their status and their powers directly or indirectly from popular sources. And the rules and laws of government under which he works rest upon expressions of popular will in the form of majority or plurality decisions. Is there in this system any guarantee that the conclusions of government, especially those bearing on complicated operations in tech-

nology, will comport with the requirements of rationality, plan, and efficiency which form the fundamental considerations of technological thought? For an answer, inquiry into the assumptions and realities of popular government is appropriate.

**Theoretical Advantages of Democracy.** What are the merits and demerits of law-making by direct popular vote? Political scientists are far from united in their answers to this question. Many of the states and cities require or permit a referendum on measures involving large public expenditures, and there is a general agreement among them that this procedure is sound and meritorious. Speaking of the referendum in general, political scientists, if critical of details, recognize certain values in it. It permits the citizen to exercise a salutary check on the legislature when the latter fails to act as a truly representative body. The operation also draws the voter into political activities, giving him a practical training in government that it would be difficult to acquire otherwise than by direct participation.

But why go to all the trouble and expense of referring measures to the masses when so many people show no interest in politics, so many are grossly misled by current propaganda, and so many are inadequately trained? This question has led some students of political science to seek, in alternative forms of government, a more efficient arrangement. Under the dictatorship, they point out, one man or at least a small group of men controls the government, and is bound to respect more or less the whims of the populace. With an "ideal" individual in charge, they urge, management can approach perfection. Similar arguments are advanced in favor of a fixed aristocracy, where the base of power is broadened only far enough to admit a limited élite—in practice usually large landowners.

Unfortunately for such projects the deficiencies of human nature creep into the highest places. Leaders competent to deal with large-scale technological operations are scarce.

Ignorance, obstinacy, a sense of unwarranted security, and a failure properly to gauge mass feelings have proved the undoing of many a government resting on the absolute power of a single ruler or an aristocracy. Recent history is replete with instances of monarchies crashing to the ground, yielding to republics; and the ways of dictatorship in Russia, Italy, and Germany have not been so smooth as to warrant confidence in the automatic competence of that type of government.

Nor does there seem to be any easy way of determining the issue. If anyone contends that popular control should be abolished to obtain technical competence in government, he is under obligation to show that his proposed alternative will assure the desired competence, and that technical competence is in itself preferable to the values of democracy. How can he do it?

**Democracy Based on Equality.** Majority or plurality rule on election day has been historically justified on the theory that all voters are innately equal, the views of one individual properly having the same weight as those of any other person. When democracy first gained a foothold in America, there was indeed a certain rough equality among the people. There was no established clergy, no titled nobility, no drifting "mobs." Land was the chief form of property, and its wide distribution in a virgin continent, among freedom-loving people, brought about a considerable amount of economic parity. Furthermore, the number of trades was small; the differentiation of industries had not yet reached the point where the total population was divided into numerous special interests.

Of this early similarity, which formed a genuine basis for the head-counting process, a fraction still remains. As human beings we all have a variety of experiences. We are all born as helpless babes needing care. During childhood we receive the compulsory minimum of schooling. As adults we make love, usually we marry, we grow old, we die. To



this identity of biological experience must be added the standardizing effects of modern mass-production which has given us the radio, the newspaper, the automobile. On a series of questions, such as prohibition, good roads, gasoline taxes, or marriage and divorce statutes, we are all fairly competent to express an opinion and, since the enforcement of such measures depends upon popular support, the will of the people is an essential force in carrying on many functions of government.

**Effects of Specialization on Equality.** But the general equality, upon which historic democracy was based, has been seriously curtailed in modern times through the development of science and machinery. The advance of technology has largely destroyed the old occupational parity by forcing upon us an ever-increasing measure of specialization. Federal census figures for 1930 reveal the quantitative results. In the single state of Massachusetts, as against 56,000 agricultural workers and 8,000 men engaged in fishing and forestry, there were 126,000 workers in the metal trades, 148,000 in transportation, 95,000 in leather plants, 173,000 in textile mills, 3,000 extracting minerals, 154,000 in the professions, 52,000 in public service, 118,000 in the building industry, 189,000 in personal or domestic service, and 325,000 in trade. In every one of these broad classes, of course, there are numerous subdivisions. In all industrial sections of the country a more or less similar differentiation prevails.

Briefly interpreted, the chances are that those voters whose expert knowledge really entitles them to express a valid opinion upon the merits of any great technical question in government will always be swamped at the polls by a body of laymen, casting ballots "without fear and without research." The determination of public policy respecting technical issues by the head-counting process is thus likely to run counter to the findings of technology itself.

**Voter Often Incompetent.** Probably no better illustration of the way in which expert opinion may be buried in an

avalanche of lay prejudices can be found than the vote on the Erie Canal enlargement. In 1903 the voters of New York were called upon to decide whether or not the state should issue \$101,000,000 in bonds to pay for widening and deepening the old Erie Canal to permit the passage of 1,000 ton barges. Shortly before the polls opened, a leading engineering magazine of the day—*The Engineering News*—circularized noted experts to discover their attitude toward the proposal. To prevent undue favoritism from being recorded in the canvass, engineers directly interested in the canal project and engineers employed by competing railway systems were passed over. Authorities replying to the letter were twelve in number, including the Director of the Rensselaer Polytechnic Institute, the Dean of the Engineering School of New York University, the head of the hydraulic laboratory at Cornell University, a high officer of the United States Army Corps of Engineers, and a number of nationally prominent consulting engineers, familiar with waterway matters. Of the twelve, ten opposed and two favored the enlargement plan. The opposition was emphatic. One writer declared that the building of the canal "would be a colossal financial blunder for the state of New York." Another held that "the promised advantages to the public from the construction of a barge canal are dreams that will not be realized." A third stated that "the voters of the state will make a grave mistake in authorizing the improvement." This straw vote of experts condemned the scheme. Nevertheless the popular majority in favor of the improvement amounted to 245,312 out of a total vote of 1,100,708.

Who was right, the experts or the public? In the thirty odd years that have passed since that fateful election day of 1903, time has rendered a clear verdict—the jury of engineers was correct. The \$101,000,000, originally authorized, proved to be totally inadequate, necessitating the sinking of an additional \$70,000,000 in the improvement; even then the work could not be fully completed in accord with the initial

program. To the burdens of construction must be added some \$3,000,000 a year for operation and maintenance of the route on a toll free basis. In spite of the enormous expenditures, and freedom from tolls, the development failed to bring marked increases in traffic. During the first seven years after the opening of the new channel, only 1,945,000 tons per annum went over the waterway, as compared with the 2,030,000 tons that had made use of the smaller facilities that existed in 1911, eight years before the enlarged passage was made available to the public. Records of an earlier date offer still more unfavorable comparisons. The average tonnage on the canal for the period 1877-1882 was approximately three and a half times that carried after the improvement. In a study of water *versus* rail transit throughout the country, Harold G. Moulton concludes that "the present traffic figures in comparison with those of the old Erie Canal suggest that there was no compelling reason why the canal should have been enlarged." When a mass of lay voters, possessing no adequate technical competence for passing judgment on great engineering works, is called upon to settle the fate of the latter by marking crosses on sheets of paper, errors are bound to result, often costly errors.

**Campaigns to Instruct the Voter.** Possessing little or none of the training requisite for judging the merits of most technological issues, the voter must depend on outside advice, if he would render anything more than a snap judgment. Fortunately, modern science has provided us with the necessary means of disseminating information rapidly over a wide area. Radio programs and the newspapers enter the majority of homes daily, offering ideal media for direct contacts with the citizen. Movie newsreels and the mails afford supplementary channels. Information respecting the merits of technical issues pending before the voters can be quickly transmitted to them. Unhappily there is no guarantee that such information represents an accurate technological verdict.



**"30 CENT GAS"  
A FRAUD**

Charges of "30 cent gas" are being made by a prominent Canadian Agent. The charges are that the Ontario, New Brunswick and N.S. Companies refuse to sell gas at 30 cents per therm. They say the charge is a fraud. The gas is sold at 10 and 12 1/2 cents per therm.

**HEAR  
GOVERNOR  
FOR FIGHT  
"30 CENT  
GAS"**

Charges of "30 cent gas" are being made by a prominent Canadian Agent. The charges are that the Ontario, New Brunswick and N.S. Companies refuse to sell gas at 30 cents per therm. They say the charge is a fraud. The gas is sold at 10 and 12 1/2 cents per therm.

**NEAR  
GOVERNOR  
RULPH  
14th St. NW  
MTC  
...NIGHT**

The State of California is a progressive  
nation. The change is made with enough  
national Act. The change is made with enough  
It's on the ground that the national government  
The state can't do it unless the national government  
There is such a change in the  
and here's the  
...night

Concerning the Oil Control Act, No. 1 on tomorrow's ballot, K. R. Kingsbury, President of the Standard Oil Company of California, makes the following statement:

"The vote on the Oil Control Act should be 'YES.'"

WILLIAM C. KIRBY, JR., 1937

Our Stand  
AGAINST  
OIL CONTROL  
BIL  
HARKEY  
PROPOSITION NO. 1  
INDEPENDENT and COMPETITIVE

INDEPENDENT, PROPOSITION

CONCERNING  
The State Stabilization Act  
(Senate Bill No. 162)  
Proposition No. 1

Bills passed by both branches of the State Senate Legislature in 1915 and signed by our former Governor, it is to be passed upon by the voters of California at the Presidential election in November, May 1916.

**PUBLIC INFORMATION**  
CHENNAI & CAR ASSOCIATION

ON THE  
OIL CONTROL  
BILL

*Phenol* is used for a treatment of *Microsporidiosis* (Flagg, 1997). It is found in a number of

GUIDE | ... of "Prosperity" and "Employment"  
... Old Control Bill would bring to California

NO

**The Monopoly Cannot**

...and Fool the People

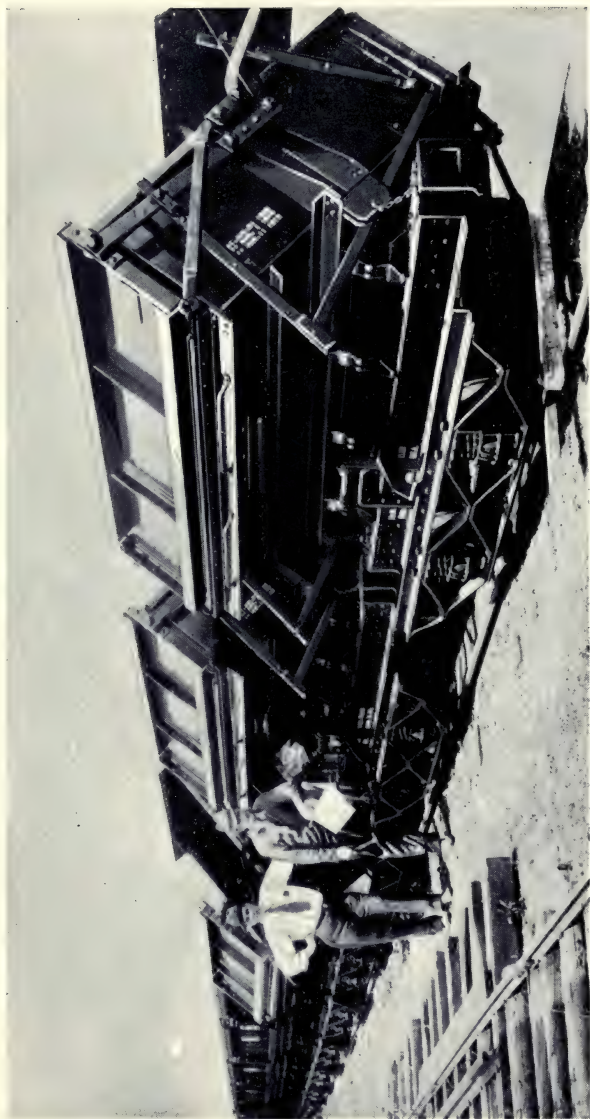
[illegible]

**FOR BETTER TIMES**  
California needs the Oil Control Act  
All Business needs it—YOU need it

**TOMORROW**

## SAMPLE CAMPAIGN MATERIAL

Typical examples of the material placed before the voters of California prior to an election on a petroleum control measure.



*Photograph by Acme Newspictures, Inc.*

#### TANGIBLE ELECTION RESULTS

By popular vote, the Metropolitan Water District of Southern California was authorized to proceed with aqueduct construction (*see* opposite page). The above photograph shows one of the earliest results of the election—the delivery of dump cars to the District under the newly approved program.

Just how the apparatus for the transmission of information can be employed in practice may be illustrated by a California example. The Metropolitan Water District of Southern California was created in 1927 to carry Colorado River water to the region comprising Los Angeles and adjacent municipalities. In the end, popular approval of a bond issue of \$220,000,000 to defray the cost of building a 270-mile aqueduct was sought. The District authorities, eager to win a victory, started educational work in favor of the expenditure at an early date. They took advantage of many channels. They kept the project before the public eye through the newspapers. At large general assemblies, such as fairs, these officers arranged displays, the nucleus of which was a huge relief map showing the route of the aqueduct as well as the area to be served by it. The "silver screen" was called into play, the District preparing movie reels in support of the bond issue, and effecting a wide distribution of the films among theaters throughout the area concerned. Posters and banners upholding the district program were everywhere to be seen, not only on the regular billboards but also in street cars and on private vehicles. Radio talks were arranged over local stations, reaching the large potential audience of the air. To serve as headquarters for direct personal contacts, organized publicity offices were established at strategic points for distributing data wholesale. To attract the attention of any citizen who might otherwise escape the excitement, circulars were mailed to householders throughout the District. Following similar tactics, interested city water departments attached small leaflets, urging approval of the bond issue, to all bills sent out to customers. Householders found favorably inclined to the plan were assembled and urged to get out the vote; many of them donated the use of their cars for the transportation of persons to the polls. No stone was left unturned in the effort "to put over the project with a bang."

The opposition campaign was much less extensive. Hav-



ing no official support from any city government, it could not offset the circularization of customers by city water departments. Being unable to convince the majority of the newspapers of the merits of its arguments, it rarely secured free news stories. Nevertheless, the opposition made extensive use of the radio, distributed a number of pamphlets, and presented its side of the case through paid advertisements in metropolitan dailies. In the end the opposition was badly defeated by heavier publicity battalions.

**Do Campaigns Enlighten or Confuse?** In most political campaigns involving the approval of technological projects, the issue at stake is not presented on its merits as a technical plan designed to accomplish given results, and seldom does a disinterested engineering magazine or society take the trouble to state the issue in scientific terms. On the contrary, it often happens that engineers abandon their science and become interested parties to the dispute, either as the employees of the government or of private concerns. In such cases, the outcome is likely to depend, not upon engineering rationality, but upon the barrage of publicity laid down by the contestants aligned on opposite sides in the campaign. In such cases the longest purse or the heaviest battalions usually carry the day.

Apart from the problem of the relative amount of the publicity handed out to the average voter, stands that of the animus which shapes the arguments. Often the sources of specific information are so efficiently covered up that the citizen is unable to trace the bias involved. To be specific, a favorite mode of publicity is to issue material under the stamp of a "citizens' committee." Thus, when the water and power issue appeared on the political horizon of California in 1922, the Greater California League burst into print. Opposing government entrance into the utility field, the organization put out a pamphlet entitled "Shall California be Sovietized?" In the introduction it was declared that "the following statement has been prepared by the

sub-committee of the advisory committee of the Greater California League." What was this unit, appearing as a citizens' organ? In sworn testimony given during an investigation of the affair, it was revealed that it was the brain child of one Mr. Gulliman, employed by power companies to campaign in their interest. Mr. Gulliman said: "It was like most political groups—never had a meeting—I appointed myself president and met with myself after employment."

Existing agencies of long standing may also be utilized in political contests involving technological operations, the exact process remaining somewhat obscure to the public. The Chamber of Commerce, for instance, in one state, was employed as an intermediary through which speakers favorable to public-utility groups were booked for speeches and lectures to general assemblies. The interested party in the case covered up the fact that the expenses of the lecturers were paid by the utilities, and chose the titles of the speeches and lectures with a view to hiding the connection.

To cite another example, through the purchase of advertising space in newspapers and journals, a powerful propaganda organization succeeded in placing its views on utility questions in the news and editorial sections of the publications so favored. The news and editorial material was not labeled, even though it was often published verbatim as furnished to the newspapers by the special interest concerned. One agent of the organization stated that as much as 5,000 to 8,000 column-inches of "information" was thus surreptitiously inserted in current journals per month. Even the ostensibly unbiased Smithsonian Institution of Washington was drawn into the fray. Under its seal, a booklet was printed dealing with public ownership of light and power when in fact the author had been hired to write it by American utilities. To continue, the National Electric Light Association furnished funds to Harvard University to pay for the preparation of a treatise on utilities which, the donor

thought, "would better appear under academic auspices than as a publication of the Association.<sup>1</sup>" The citizen, when he is supplied with information on important issues, often has no knowledge of its true origin and no criteria for passing on its merits.

**Reform through Government Publication of Campaign Texts.** For the purpose of insuring a degree of justice to opposing groups, a few states have adopted a system of "official" campaign documents. In Oregon the state government issues and mails to all registered voters before election day a pamphlet containing the texts of measures to be submitted shortly at the polls. Private parties may, at their own expense, prepare statements for insertion in the volume. Unfortunately one or even both sides may be unable to take advantage of this opportunity, so that the leaflet in circulation may be all out of equilibrium. More justice is secured by the California plan under which arguments for and against referendum bills are mandatorily assembled by state agents and printed together in the "official" books. As a means of educating the citizen, the method has much to recommend it. It substitutes coördinated information for the scattered contacts with rival propaganda that otherwise influence opinion in the determination of popular will.

**Reform through Lightening the Burden on the Voter.** Of course any presentation of material, however fair, is wasted unless the voter is willing to read it. Casting ballots and studying grave issues is a leisure-time occupation for the voter; the available hours of the day permit him to review only a few of the many modern problems. If the public is called upon to settle more difficulties than it can wisely manage, the system, critics allege, breaks down. Thus in one Oregon election, thirty different measures were simultaneously presented for final determination at the polls. The

<sup>1</sup> The electrical utilities repudiated the worst of these practices, in 1933, by dissolving the National Electric Light Association, creating in its place a new body—the Edison Electric Institute.



official booklet giving an explanation of the proposals contained 300 pages of fine print. Referring to the pamphlet, William H. Taft exclaimed: "If the reader does not lay down the book . . . with fatigue, confused mind, tired eyes and a disgusted feeling, I am mistaken. If it has that effect on the reader, consider how much more tired and confused the perceptions of the voter of average intelligence must be. It is not too much to say that only a small percentage have the patience to read through the proposed bills, much less the knowledge and persistence to learn what they mean and decide upon their effect and value." Thus, the argument runs, the initiative and referendum, if desirable at all, can only be used effectively on a small number of issues at a time.

**Changed Attitude of Technicians Desirable.** The initiative and referendum present great difficulties in matters technological. The latter can seldom, if ever, be entirely separated from questions of public policy, but usually they can be set up in positive form. For example, whether a government should establish a given irrigation or water-supply system is a problem on which technology as such has no special authority to speak; but whether the proposed bond issue will cover construction costs or the proposed plant will deliver the water as desired and required is a problem in physical science which technology can solve with reasonable precision.

If those who submit measures involving highly complicated technological operations to popular vote had a wider knowledge of the technical implications of their proposals, and if engineers, concerned as officers, voters, or interested parties in such contests, were trained to see the legal and political implications of their work, both public and private, the issues of law-making and administration could be clarified. In this case, technological considerations could be set forth specifically, and questions of policy in government separated from matters of engineering fact. So far as engineers are concerned, the function of widening their out-

look belongs largely to the technical schools. What colleges and schools of the liberal arts can do or should do in this respect must be left to the political scientists.

With respect to law-making by legislatures, the problem is also complex. Here public interests in a broad sense are supposed to be controlling and a legislative body composed of mere experts in the subjects of legislation coming before it might well be lacking in its understanding of public interests. In this field longer terms for legislators, a more precise adjustment of legislative committees to the different types of work before them, a closer integration of legislative bureaus with technical administration in government, and a wider use of experts in legislative investigations might improve legislation on the technical side. Perhaps it would be easier to give laymen the technical competence necessary for their work than to transform technicians into statesmen. Where two such parties are involved in a common enterprise, it is well for them to draw together and for each side to take thought about the problems and duties of the other.

**Competence of Elective Officials.** When the engineer, confronted by this perplexing question, turns to the treatises on political science and the debates of current politics, he finds no axioms so commanding as the conclusions, let us say, in his handbooks on hydraulics or steel construction. Although the fact and desirability of popular control are generally taken for granted by writers on American government, the devices and methods for effecting that control are the subjects of lively criticism and defense on the part of publicists. They generally agree that the popular election of officers and legislators does not automatically secure the choice of persons competent to deal with the highly technical questions, both technological and economic, which come before them for consideration, decision, and action; but there agreement generally ends. Whether the trouble lies in the nature of popular election or in the mechanism employed in politics has not been determined as yet.

**Improving the Quality of Officials.** Not much advance is likely to be made by debate along this line. The practical engineer will be inclined to say, along with specialists in administration, that the problem of selecting competent officials consists in (1) discrimination between general officers and experts in particular sciences, (2) the establishment of the training and other qualifications necessary to competence in experts, (3) the substitution of appointment for popular election in all cases where mere technical competence is the prime consideration, and (4) the limitation of appointments in such cases to persons who have duly qualified. Here the records of candidates as students in technical schools and the judgment of professional bodies, such as engineering and scientific societies, might be employed in the determination of choice.

**Restricting the Use of Money.** Further improvement in the quality of officials may be secured by removing the advantages enjoyed by wealth. The Congress of the United States and state legislatures have enacted laws limiting and controlling the use of money in campaigns and elections. Such laws usually fix the amount of money which a candidate may spend in seeking his nomination and election, either at a definite sum or a percentage of the salary attached to the office in question or so much for each voter in his constituency. They also provide, as a rule, for the publicity of campaign expenditures made by candidates, parties, and associations engaged in influencing voters one way or the other. These laws have undoubtedly had some effect on the use of money in campaigns and elections, but they do not control all pecuniary operations in the formulation of popular will. Friends of candidates may spend money freely. The reports of expenditures made by candidates, parties, and associations are generally buried in official archives, unless there is a scandal, and the public at large may never know anything about the amounts expended in manufacturing opinion.



**General Conclusions.** It is clear that under the modern conditions created by technology, broad masses of the people are vitally affected by, and dependent in a considerable measure for, their security and prosperity upon acts of government. When the chief business of government was to collect taxes, maintain order, and fight wars with primitive weapons, this was not the case to anything like the same degree. But the old conditions have passed. Acts of government deeply touch the welfare of masses, and the interests and opinions of masses must be taken into account by governments, whether they are democratic or dictatorial. Even the strongest dictator is no stronger than his popular support. It is true that popular opinion can be manipulated extensively by minorities, but in the long run only within certain limits set by the nature of industrial society founded on technology. If manipulation is not to destroy society, it must be controlled by some understanding of the enduring interests of society and be restrained by consideration of those interests. So at bottom it is a question of obtaining the widest possible knowledge of society as conditioned by technological industry and making that knowledge available to the masses of people whose welfare depends upon the rational and efficient use of technology in economy and government. That we are a long way from that ideal state of affairs is made evident by even the most casual study of contemporary government and politics.

Nor will it be easy to institute that desirable state of affairs. Government by head-counting is an old and established tradition. It began long ago when the United States was an agricultural country and government was simple. The necessary knowledge was relatively easy to acquire. Conditions were fairly well settled. Changes were slow. In contrast, conditions in a technological society are very complicated. Exact knowledge of them is hard to obtain, even for those who have a good education. They are changing rapidly and knowledge can scarcely keep up with the facts. And

this knowledge in the best of circumstances is not clear and consistent. It is not definite and positive, like an engineer's handbook, from which information guaranteed to work can be obtained. Although engineers are largely responsible for these technological changes, their knowledge of the proper adjustments necessary on the part of society is often slight and not a bit ahead of the average run of popular opinion. If technology could be stabilized for fifty years, adjustments would be easier to work out, but with technology making one revolutionary invention after another the business of government becomes a race with startling events. The use of rationality is required in dealing with technological operations and yet precedent, tradition, and passion continue to be largely dominant in government—whether democratic or dictatorial.

## CHAPTER IV

### THE SEPARATION OF POWERS IN GOVERNMENT

**The Three Branches of Government.** When the engineer turns from a consideration of the methods by which popular control is organized and made effective in government to an examination of government itself, he must familiarize himself with its internal structure at the very outset. This he is under obligation to do whether he is an employee of government, is engaged in an enterprise subject to its regulation, or is merely thinking about the relations of technology to government. On inquiry into any typical unit, three main parts are usually revealed. There is the legislative branch, whose prime duty is to formulate and enact legislation. Laws, once in effect, are then put in the hands of a second department, the executive, which proceeds to enforce them. Finally a third agency, the judiciary, is charged with the task of interpreting the laws in general and in detail, passing upon their validity, and applying them. Political scientists commonly refer to the fundamental principle upon which this triple division of functions is based as the "separation of powers."

**Examples of the Separation of Powers.** This separation is to be found in the Federal Government where Congress discharges legislative duties, the President is chief of the executive branch, and the Supreme Court heads the judicial structure. On the same principle, every one of the forty-eight states divides its work of government among three agencies. Each has a governor to enforce the laws, a legislature known by some special name such as the General Assembly, and a hierarchy of courts. Among local units, a kindred practice is often to be found. A typical city or-



ganization is composed of a mayor or manager in charge of the executive department, a city council busy with law-making, and a system of judicial tribunals. However, a number of municipal governments have departed from historic precedents, combining rather than separating powers, as we shall see later (p. 99).

**Historic Background.** Centuries of history provide a background for current practices in the separation of powers. Tyrants, old and new, have often won the right to perform the triple feat of making laws, enforcing them, and determining their meaning. A single person, in such a strategic position, could devise measures at the merest whim, carry them out with the greatest severity, and convict persons without mercy. Some means of offsetting such evils were naturally sought by advocates of liberty for persons and property. In time the conclusion was reached that if one group of government officers prepared laws, another executed them, and still a third passed upon their validity, the system of checks and balances thus placed in operation would prevent many abuses. If, runs the reasoning, the legislature puts through a statute that clearly violates the written constitution, the executive may veto it, or the judiciary may put on the brakes by declaring it void. Simply stated, this is the fundamental idea behind the doctrine of division of powers.

**Separation Never Complete.** Paradoxical though it may seem, the separation of powers can be maintained only through partial combination. Each of the three branches must be given some means of defense against the attacks of its coördinates. Such means commonly take the form of overlapping control. To illustrate, state governors exercise the power to "veto" statutes that are obnoxious to them (p. 125). In this manner, they are able to protect themselves whenever legislators seek to interfere with executive officers in a manner deemed unjustified. In like fashion, it is a common practice to permit legislative bodies, either one house

or both, to pass upon the qualifications of nominees for high executive posts in the course of ratifying or approving appointments. Law-makers are thus in a position to prevent the filling of important executive vacancies with tyrants who would ignore their desires. Overlapping of duties, accordingly, helps to prevent a concentration of control in the hands of any one department that would reduce other departments to the level of helpless subordinates.

**The Theory Examined.** One of the fundamental purposes of the separation of powers is to put a brake on the action of government. In the case of the Federal Government this is done ingeniously. The President is elected indirectly by electors chosen by popular vote in the several states; his term is four years. The Senators are elected for six-year terms and one-third go out every two years. Members of the House of Representatives are elected for two years. Judges of the Supreme Court are appointed for life by the President and Senate. This makes it difficult for one political party to get hold of all branches of the Government suddenly and put its plans into speedy effect. Bills passed by the House are defeated in the Senate. Bills passed by Congress are vetoed by the President. Laws enacted by Congress and signed by the President are set aside by the Supreme Court as violating the Constitution. The President may defeat the purposes of Congress by failure to enforce properly a law which it has passed.

To an engineer this may seem strange. It is as if a construction engineer were to defeat deliberately the plans of the designing engineer by preventing the carrying out of his design. Certainly engineering work would be in a jumble if the several parties to an undertaking were constantly at logger heads, if their organization were set up to facilitate disputes rather than harmonious coöperation. In government, of course, there may be times when delays do not matter, but there are other times when action and coöperation are absolutely necessary. So the theory of the

separation of powers, although a tradition of government, becomes a matter of practical concern in carrying on government in an age of swift technological changes and adjustments.

**Commission Government for Cities.** Delay may prove more objectionable to citizens than the evils it seeks to forestall. When, for example, a storm and tidal wave swept over Galveston, Texas, in 1900, hundreds of persons were killed and enormous property losses were suffered. The city was in ruins. Municipal funds were low. Chaos prevailed. Yet the local government could not get under way with sufficient speed to straighten things out. Impatient with historic theories, prominent residents decided upon drastic steps. They drew up a new form of organization, finally winning the right to put it into effect. The product was the "commission" plan. Five men constituted a central body, possessing all legislative and executive authority. One member served as mayor, while the others took charge of the administrative departments. Collectively they made and enforced laws for the entire city. So successful was the novel experiment that other centers became interested and hundreds of cities adopted this scheme for fusing legislative and executive duties; but many later adopted the city-manager plan.

**County Boards.** Going up the scale from cities to counties, we find once more that the separation of powers has been ignored. Counties are commonly governed by bodies bearing various names, such as board of supervisors, board of chosen freeholders, board of county commissioners, or board of revenue. The limited legislative authority accorded to counties by the state is usually exercised by an elected board of this character. It makes local sanitary ordinances and appropriates money for current expenses. In the county there is rarely a single executive head, corresponding to the state governor or the city mayor. Consequently the board must take charge of administration. Roads and bridges



are laid out, built, and maintained under its supervision. So are levees, dikes, irrigation works, and swimming pools. In addition to assuming legislative and executive tasks, the board sometimes discharges certain judicial obligations. In the counties, then, as well as in cities with commission or city-manager governments, we see a concentration of control running counter to the theory of checks and balances.

**Administrative Rule-Making.** A second type of legislative and executive combination results from empowering administrative agencies to make "rules." Federal law, for instance, provides that the Secretary of Commerce shall draw up regulations governing the operation and licensing of interstate aircraft. Under this enabling provision, elaborate detailed requirements controlling the design of equipment and movements of air traffic have been promulgated. Under similar provisions, the national Steamboat Inspection Service authorities prepare specifications for boilers, fire-fighting apparatus, and other parts of powered water craft. Kindred practices prevail in state and city governments. To cite one case, Connecticut requires that all brakes and headlights on automobiles shall conform to the orders of the state motor vehicle commissioner. In short, a multitude of technical matters is subject to the law-making authority of administrative officers in the executive department. As governments exercise increasing control over technological construction and operation, the tendency to delegate legislative power to executive agencies, in fact if not in legal theory, becomes more marked, pointing to changes in the historic "separation of powers."

This custom is attended by certain advantages, one of which is speed in the making and revision of laws. Regular legislative assemblies, meeting only at intervals, and jammed with business of all kinds, are seldom able to devise and enact new bills the moment engineering developments call for instantaneous action. On the other hand administrative officers, on duty continuously, and confining their attention

solely to limited fields, are able to alter rules whenever such a step appears necessary. As examples of the type of technological progress which demands quick response two cases may be noted. A New Jersey bus requirement specified a maximum overall length of twenty-eight feet for vehicles, but permitted a total body length of but twenty-four feet. Suddenly a motor bus appeared with the engine housed inside the body so that body and overall length became identical. The resultant loss of four feet in extreme dimensions was unfair to owners. Again, the development of the autogiro or "flying windmill" gave rise to a hurried demand for modifications in existing aircraft regulations. Administrative rule-making, being rapid, is eminently suited to this present age of constant improvements in design.

Competence enters as a second factor. Legislatures are ordinarily composed of laymen, unacquainted with technological work. Lawyers rather than engineers and scientists predominate. Administrative officers, in contrast, are generally chosen with an eye to their expert training. The latter are consequently better prepared by knowledge and skill to draw up many regulations than are legislators. An illustration may be taken from radio history. In 1927 the national Congress allotted broadcast power among the states and possessions on the basis of population. Thus Alaska received 380 watts while New York was given 35,100 watts. Unluckily for the law-makers, the quantity of power that will cover a given region, without undue interference, depends upon its area and not at all upon the number of its inhabitants. As Alaska has twelve times the surface of New York, it should have twelve times the power, whereas it actually was allotted one one-hundredth as much energy. So the statute flatly ignored known physical facts. Results may be described in the words of Senator King: "The state of New York, with its great center of population, is entitled to and has more radio facilities than a half-dozen of the sparsely populated states of the West. In the New York

area, therefore, the congestion is reported to be so great that interference results with reception, while out in the Intermountain Empire many barely can receive one station." If the handling of such matters had been placed in the hands of skilled executive rule-makers instead, action in keeping with technological requirements could have been quickly taken.

But fears of expert dominance are not easily allayed, as evidenced by the cautious manner in which legislators sometimes vest rule-making powers in administrators. Instead of granting to national steamboat inspectors sweeping authority in the drawing up of regulations, Congress has sought to prevent possible oversights, to establish certain principles itself, and to guard against failure of the technicians to act. To insure that technicians will not neglect fire hazards, it requires vessels to carry such number and kind of "good and efficient" portable fire extinguishers as in the judgment of the board of supervising inspectors seem necessary. For kindred reasons, minute guides as to boiler design and other technical matters are scattered throughout our steamboat statutes. The outcome is that technical officers are in many cases limited to the routine of following detailed orders rather than left free to apply the latest principles of safety.

Another illustration of technological problems involved in the separation of powers may be given. In 1929 West Virginia passed a hydro-electric act. Thereafter companies seeking the right to make use of specific sites were required to secure it from the State Public Service Commission, of which the governor was made a member. This body was authorized to investigate the effects of such proposed developments and "to weigh from the standpoint of the state as a whole and the people thereof the advantages and disadvantages arising therefrom." Ultimately the validity of the entire measure was attacked, bringing it before the state Supreme Court of Appeals for examination. The latter held



that the awarding of licenses for water-power operations, "with the interests of the state as a whole" as a basis, was clearly a legislative duty. A second complication also arose. In case the Commission saw fit to reject the petition of a concern, the latter was allowed to take an appeal to the Circuit Court of Kanawaha County. The county court was to proceed to review the matter, using original data collected by the Commission as a basis for rendering a verdict. But here also it seems that the "legislative" task of looking after the best interests of the state was involved. Briefly, it was said, "legislative" authority was being exercised by both executive and judicial organs. So the whole statute was annulled by the Court of Appeals on the ground that it contravened doctrines of *separate powers* as expressly set forth in the state constitution. By such legal reasoning is the fate of separation and combination sometimes determined.

**Administrative Tribunals.** Paralleling the combination of legislative and executive powers is the occasional union of administrative and judicial duties in the same hands. Thus local boards of steamboat inspectors, operating under national authority, function as courts, in addition to discharging their regular routine tasks of making rules and checking vessels. These bodies have the power to summon witnesses and compel their attendance, to administer oaths, and to impose penalties in the form of revoking the licenses of ship officers adjudged guilty of failing to observe technical rules or displaying gross negligence. Mimicry of the courts is carried further, for there is a system of appeals from the decisions of local boards to the supervising inspector of each steamboat district and in turn from him to the Supervising Inspector General in Washington, D. C. In appeals the accused has the right to be heard in his own behalf and to be represented by counsel. Other instances of administrative tribunals include those charged with trying and punishing offenders against Federal air traffic rules. The development is significant, indicating that there are ever-widening areas of

law enforcement and adjudication in which only technicians are competent to say what "guilt" really is.

As in the case of legislative and executive combinations, important advantages with respect to speed and competence may be secured through the proper use of such administrative tribunals. Court calendars are today notably crowded, resulting in long delays on occasion. Where business is short-circuited through administrative officers, time may often be saved. The second factor, technical training, is equally vital. The steamboat inspectors who hear cases of law violation or negligence aboard ship are required by law to satisfy certain standards of professional ability before they are appointed. By statute, every hull examiner must be a person "who, from his practical knowledge of shipbuilding and navigation and the uses of steam in navigation, is fully competent to make a reliable estimate of the strength, seaworthiness, and other qualities of the hulls of vessels and their equipment deemed essential to safety of life in their navigation." Where complicated technological situations must be analyzed in the course of trials, therefore, steamboat inspectors are fully prepared to interpret the law, discover actual violations, and render verdicts on the basis of fact and evidence. Lay judges and juries could not work with such assurance under the same conditions. Hence the administrative tribunal has come to stay as a means of insuring swift and effective action.

#### **Administrative Bodies Exercising All Three Functions.**

Sometimes all three functions, legislative, executive, and judicial, are discharged by the same persons. Reverting again to the work of the national steamboat inspectors, we find these men periodically assembling to draw up new regulations—to make laws. These requirements they proceed to enforce as they go about their task of checking boilers, hulls, and equipment. Finally we see them sitting as a court to determine whether or not some responsible officer aboard ship has ignored their orders, and to penalize him if he has.

Here we have a single group with combined powers, the very thing which the fathers of our country thought they were preventing by their insistence on the separation of powers. But modern industry moves fast, demanding speed and ability, changing historic concepts to meet present-day necessities.

**Trend Away from a Division of Powers.** From this survey of the separation of powers in its technological aspects certain important conclusions emerge. The construction and operation of engineering enterprises often involve the entire legislative, executive, and judicial process which the lawyer seeks to divide into three distinct compartments. Where speed of action is a primary consideration, because of rapid technological changes, the system of checks and balances, as now handled, makes for friction, delay, and a wasteful lag between law and technology. Where highly technical issues are raised, the legislature and the courts are often incompetent to pass judgment. In practice the theory of separate powers is frequently ignored, although legal formulas are found to cover the apparent violation; in many technological fields there is a tendency to transfer both rule-making and adjudication to boards and commissions composed of technicians. As the functions of government multiply and as it extends its regulatory and supervisory power over private undertakings of a technological nature, this tendency to fuse legislation, interpretation, and execution will doubtless be accelerated.

**Dangers in Expert Domination.** The engineer should be on his guard, however, against the easy assumption that technology will supplant politics even in the technical areas of government. Theoretically the deliberative and judicial qualities of legislators and judges should not enter into decisions at all in these areas: the engineer knows whether boiler plate of a given tensile strength will bear two hundred pounds of steam pressure. But other things must be taken into account. Whether a given engineering work should be undertaken, or whether the public should be protected



against boiler explosions, is a question of human values for society to decide. The purpose of the work and the degree of safety to be provided are human questions. Moreover the engineer is a human being and for various reasons he does not always follow the rationality and efficiency of his science to their logical conclusions. He may be negligent or corrupt or indifferent to duty, unless controlled by lay authorities acting in the public interest. If engineering, viewed as an exact science, would require the fusion of legislative, executive, and judicial functions in great areas of technological operations in government and the exclusion of lay authorities entirely from these domains, the human considerations involved would make such a clean-cut union and excision impossible in practice and undesirable from the point of view of the public interest, which is supreme in final analysis. Here, as elsewhere, the relation of the expert to the layman is drawn in question.

#### “RECOVERY” AND THE SEPARATION OF POWERS

**Tendencies.** In the above outline certain tendencies with respect to the separation of powers are evident. Practice tends towards the liberal interpretation of the conception that legislative, executive, and judicial powers cannot be absolutely separated, even in a lawyer's formula. Legislatures quite often “delegate” to executives complex and sweeping powers of making rules and ordinances, which are legislative in nature whatever may be the fine distinctions of language employed by the courts in upholding such actions. In cities, where problems of technological government are more complicated than in rural regions, there is a marked tendency to abandon the historic idea of separating the powers of government; under the city-manager plan, the executive is subordinate to the city council, for the council elects and may remove him at will. As governments are compelled to deal continuously and flexibly with great technological enterprises, such as utilities and railways, they

surrender, for practical purposes, legislative control in details and confer large powers on boards and commissions, transforming them into *ad hoc* legislative bodies. These tendencies were already marked before the crisis of 1929 and the Federal legislation of 1933, called in some circles "revolutionary." Judging by these tendencies the movement toward the enlargement of legislative powers in the hands of executives would have continued even if business had maintained a "normal" course.

**The Governmental Crisis of 1933.** However this may be, it is certain that in the crisis of 1933 Congress conferred upon the President of the United States wholesale law-making powers over governmental organization, finance, banking, currency, industry, agriculture, employment, and relief—powers such as had never been conferred upon a President, except, perhaps, in war time. Although many of these measures are described in detail at various points below (especially Chapter XVIII), a summary is necessary here in connection with a consideration of the separation of powers. Take first the powers over governmental organization conferred on President Roosevelt in 1933. He was authorized to consolidate, abolish, and reorganize agencies of the Federal Government, subject to a later overruling by Congress, to cut salaries and wages of Federal employees, to discharge outright employees deemed unnecessary—despite civil service rules. In the second place, take finance. The President was empowered to compel Federal Reserve Banks to buy government securities by the billion in open market operations, to issue three billions in greenbacks, to reduce the gold content of the dollar by fifty per cent, to fix the weight of gold in the dollar, to coin silver on a ratio fixed by himself, to accept two hundred millions of silver in payment on war debts, and to issue currency based on this silver. With respect to banking, the President was empowered to open and close banks, control transfers of credit between them, prohibit gold hoarding, compel the opening of bank books to

inspection, regulate the business of banks, authorize the Reconstruction Finance Corporation to assist national and state banks, and cause the retirement of circulating notes not secured by government bonds. Fourth, under the National Industrial Recovery Act, the President was given enormous powers over the licensing, consolidation, management, and operation of industries and mercantile establishments, including the power to suspend the anti-trust laws and control imports (see Chapter XVIII below). Kindred legislative powers over agriculture were vested in the President by the Agricultural Adjustment Act (see Chapter XVIII). In connection with employment and relief, although not entirely subsidiary to these matters, the President was authorized to spend \$3,300,000,000 on public works at his discretion, to make contributions and loans to cities and states, to carry out projects for the redistribution of overbalanced population in industrial centers, to develop Muscle Shoals and the Tennessee Valley as a whole, and to assist home owners in peril of mortgage foreclosures. In addition to all these things, the President was empowered to exercise a wide control in the coördination of transportation. From this bare outline, with numerous important items omitted, it is clear that Congress, in a few strokes, vested in the President far-reaching legislative powers. Indeed, some critics went so far as to declare that Congress had "abdicated."

**The Outlook for the Separation of Powers.** In the light of such actions the future of the tradition respecting the separation of powers is by no means certain. Congress has not abdicated in fact, for at any time it may revoke the legislative powers delegated to the President. Moreover, its procedure grew out of an emergency and a time-limit was placed on many of the important Acts just enumerated. Many things will depend on the course of private economy. A return to the conditions existing in 1928 or 1900 might mean a curtailment of the President's legislative authority. On the other hand, if planning and control in industry and agriculture are



found to be necessary to their efficient functioning, such planning and control must be entrusted to executive agencies endowed with large legislative powers. And if Congress is to exercise supervision over the activities it authorizes, it will be forced to make changes in its historic rules and methods, and to create new organs of investigation, scrutiny, and control with respect to executive operations—legislation and enforcement. In a society founded entirely on technology, which proclaims that “nobody shall starve” and that employment must be furnished to the able-bodied adults, planning and control in industrial and agricultural production and distribution are inescapable implications. In such circumstances legislatures composed of miscellaneous laymen, particularly lawyers, will inevitably diminish in importance as legislative agencies, but if democracy is to continue, their functions of establishing broad principles and exercising scrutiny and final authority will increase far beyond old-fashioned traditions. It is in the effective reconciliation of the legislative control with highly concentrated executive authority that the United States may escape the tendency to executive dictatorships which have overwhelmed popular governments in so many parts of the world. In the light of such considerations, the old theory of the separation of powers becomes a living issue—for operating technologists as well as for society at large.

## CHAPTER V

### LEGISLATIVE PROCESSES

We have seen how government is usually divided into three branches—legislative, executive, and judicial. It is now necessary for our purposes to examine these departments in detail. Such a study begins logically with legislative operations, for it is only under the sanction of law that public and private works are carried on. But before considering the actual processes by which measures of law are drawn up and enacted, it is appropriate to acquire some knowledge of the relative ranking and nature of laws. It is to this preliminary phase that we now turn.

#### THE RANKING AND NATURE OF LAWS

**Constitutions and Charters.** Under an absolute monarchy, there are no limits to the powers of the government; personal security for the average citizen is totally lacking. Naturally such a social system cannot fail to prove irksome to the rank and file of people. Where the spirit of liberty is strong, therefore, the populace reduces the authority of the government by forcing it to abide by a stringent “organic law” or “constitution.” This instrument sets forth at length a broad political framework and certain general principles of government and private rights, which, as a rule, cannot be altered without the consent of extraordinary majorities in the legislature or at the polls, or without encountering some checks outside the government itself.

Two types of organic law are to be found in the United States—constitutions and charters. The Constitution of the United States is the supreme law of the land. It sets up a system of national government. Then it forbids every unit

of government, whether Federal or local, to exercise certain powers deemed oppressive. A "sphere of liberty" is thus created which is free from governmental interference. As for the powers which governments are permitted to wield, they are divided, for practical purposes, between the nation and the states. Matters subject to Federal control are listed in detail, all other powers being left to the states.

Since the national Constitution does not undertake to specify the manner in which each state shall be set up, there is need for some type of law to provide for the organization of state government in order to complete the picture. So each of the forty-eight states has examined the privileges left to it by the Federal Constitution and on this basis has erected a constitution of its own, defining the rights and duties of state and local officers. Finally many minor areas, such as cities, have been granted, or permitted to draw up, "charters," setting forth the nature and powers of local government. Insofar as charters conflict with superior state constitutions and laws, and insofar as state constitutions or local charters contravene the Federal Constitution, they are void; otherwise each is supreme within its own particular sphere.

**Statutes and Ordinances.** A second group of laws consists of the general run of measures issuing from legislative assemblies or enacted by referendum. Two types of acts are recognized—statutes and ordinances—the distinction being one of origin. Bills passed by state legislatures or by the Federal Congress are commonly known as statutes, while those promulgated by cities or other units of local government are called ordinances. Statutes, of course, are valid only insofar as they comply with the provisions of the constitutions that are applicable, while ordinances must meet the terms of local charters as well. Both are clearly inferior in position to "organic law."

**Rules and Regulations.** The third and lowest type of law consists of rules and regulations prepared by administrative agencies, usually under the authority of a statute



but sometimes under constitutional warrant. Technical requirements controlling the design and maintenance of locomotives and railroad cars, promulgated by the national Interstate Commerce Commission, are typical of the group. In every case legislative bodies reserve the absolute power to alter or repeal at any time executive pronouncements made under the authority of their statutes; executive laws exist only under sufferance from constitutions and statutes.

As we noted during our discussion of the separation of powers, executive officers are theoretically prevented from engaging in the legislative function of drawing up laws. Nevertheless practical exigencies have called into existence an enormous and ever-growing body of administrative pronouncements. In the face of this fact, apologies had to be devised. Legal minds apparently found a measure of consolation in the thought that, since the novel requirements were dubbed "rules and regulations," they were somehow markedly differentiated from statutes. But as if completely to satisfy courts that they have not given away a sacred privilege, legislative assemblies appear continuously on the alert to control executive rules by statute. This preparedness to intervene lends countenance to the contention that law-making "powers" have not been granted outright to administrative agencies but on the contrary have been temporarily "lent" them, subject to momentary recapture. Furthermore, lawyers have devised a phrase—quasi-legislative powers—to cover grants of law-making authority to boards and other executive agencies. At all events the judges appear satisfied. The only importance to the engineer of such legalistic reasoning is that it has set the stamp of authority on administrative rules. To win this stamp, the latter have to be subservient to statutes and constitutions.

**An Example of Classification.** Bearing in mind the relative ranking of legislation, as described above, the chain of events running from the drawing up of organic laws to

the preparation of minute rules may be easily traced. For example, the Federal Constitution vests in the national Government full control over interstate commerce. Radio communication is, obviously enough, one phase of such commerce. So Congress clearly has the constitutional power to pass statutes regulating wireless telegraphy and telephony. Recognizing this fact, Congress worked out and adopted the Radio Act of 1927, vesting in the Federal Radio Commission the privilege of issuing detailed orders relative to transmitting equipment. Having received the necessary statutory authority, the Commission proceeded to issue a series of so-called "general orders" of its own formulation. Number 78, of December 5, 1929, one among many, deals with the manner in which formal announcements of the use of electrical transcriptions shall be made by broadcasting stations. There is the whole history—from Constitution, through statute, to administrative rule. Still more involved sequences are possible, of course, starting with the American Constitution, passing successively to a state constitution, a city charter, a city ordinance, and last of all a city administrative rule—five steps to reach a single goal.

**Constitutional Limitations Affect the Formulation of Statutes.** The unequal ranking possessed by the several classes of laws, as here set forth, has a very significant effect upon the wording of technical legislation. The framers of constitutions, being concerned with the supreme law, are so nearly independent in their actions as to permit us to pass over them without further consideration. The plight of the statute-maker, however, is far different. Government officers, when engaged in the preparation of statutes, cannot just sit down and, on the basis of the merits of the case alone, formulate the most rational type of measure that occurs to them. On the contrary they labor under the ever-present shadow of constitutions. By ingenious invention they must somehow contrive to crowd as many of the desired results into a given bill as possible, through the most

promising constitutional loopholes they can find. The engineer, once he becomes familiar with this fact, may derive considerable entertainment from watching the tortuous processes employed by lawyers and statesmen in putting their ideas into effect in the face of apparently severe constitutional difficulties.

To be concrete, there is the case of the Colorado River irrigation legislation. Shortly after the opening of the present century, Congress wished to consider the possibility of enacting legislation controlling irrigation along the stream. But could Congress deal with irrigation as such directly? No, indeed. It had to find constitutional authority for meddling with these waters before it could proceed. Now the Constitution of the United States, as interpreted by the courts, vests in Congress certain powers over navigable rivers. If the Colorado River could be proved to be navigable, then and only then, could Congress legally deal with it. Somehow, it was hoped, irrigation provisions could be wormed into a navigation bill.

Inevitably a preliminary debate broke out over the question of navigability. In 1903 Mr. Arthur P. Davis stated that "the river is navigated more or less from the mouth to the Needles by stern wheel boats, which sometimes even ascend to the mouth of the Virgin river. Its navigation, however, is so difficult and precarious as to make it almost useless. At low water the channel is so broad, shallow and changeable that boats are continually running aground—sometimes being nearly a week in advancing ten or fifteen miles. In times of high water, the swift current greatly impairs navigation. Whenever wagon transportation is possible this is preferred to the river." In short, navigation on the river existed, but barely existed. Even so, it offered the only loophole for national action. Consequently the Honorable Theodore Bell stated, in hearings on an irrigation bill, that "we can control it [the Colorado] . . . under the fiction—which is only a fiction—of the river's navigability." To



such lengths must the legislator sometimes go in order to achieve his goal!

The more detailed a constitution becomes, the more seriously it may interfere with the statutory process. Certain of these organic documents reach large proportions, that of California running to some 40,000 words. The latter contains provisions varying from the disfranchisement of those who have engaged in duels with deadly weapons, and the conferring of tax exemption on nut-bearing trees under four years of age, to specifications as to the manner of selecting the surveyor-general.

Where a constitution is so voluminous, constitutional changes and statutory enactments must frequently go together, after the manner of Siamese twins. Thus when the citizens of California wished to open a way for the introduction of voting machines in state and local elections, they had to secure both constitutional and statutory authority at approximately the same time. The wording of the amendment to the supreme law of the state illustrates the operation: "The inhibitions of this constitution to the contrary notwithstanding, the legislature shall have power to provide that in different parts of the state different methods may be employed for receiving and registering the will of the people . . . and may provide that mechanical devices may be used within designated subdivisions of the state . . ." In fine, lengthy constitutions may become a distinct hindrance to the progress of technological law-making.

Clarity in the wording of constitutions, as well as length, is an important controlling factor in the preparation of statutes. If the Constitution of the United States is examined in detail, certain phrases are found to admit of little misunderstanding. The patent clause granting to Congress the power "to promote the progress of science and useful arts, by securing for limited times to . . . inventors the exclusive right to their . . . discoveries" is of this type. Other portions of the document, however, are capable of

numerous interpretations. The right of Congress "to regulate commerce . . . among the several states" is of the latter variety. When the state of Idaho sought to levy a tax on all electricity generated within the state, it touched the interests of an electric company engaged in transmitting current to points outside the state. Holding that it was engaged in interstate commerce, the concern believed itself beyond the taxing jurisdiction of the state in this respect. The Supreme Court, on surveying the commerce clause of the Federal Constitution, maintained that generation was a local act, distinct from the process of transmission, and did not come within the definition of interstate commerce. So the validity of the local statute hinged on the ability of the Court to separate generation from the immediately ensuing passage of the current out on the wires. On such thin ice do statutes skate when based on constitutional phrases which are characterized by a vagueness that allows the judicial mind manifold opportunities for throwing its weight on either side.

It should now be apparent that important technological legislation is not debated in this country solely on the basis of its merits, in relation to public welfare, convenience, and necessity. On the contrary, discussion centers about whether higher law sanctions a revision of practice. Where a proposal requires an amendment to a constitution as a preliminary step, deep sentiments may be aroused. It is at once felt that something almost sacred is about to be tampered with. Respect for tradition and fear of wide experimentation serve to retard the shift. Safeguards against political interference, set up in organic laws, operate as brakes to forestall change. In an age of rapid engineering progress, this state of affairs is significant for the technician as well as for society at large.

**Absence of Constitutional Limitations in England.** Far different is the situation in the great industrial nation of England, where there is no written constitution. There the

government can, according to Blackstone, "do everything that is not naturally impossible." Under her system, the citizen has fewer theoretical liberties but there are no serious barriers to the swift solution of difficult problems. The sole obstacle to action is not higher law but lack of wit. Whether the evils of the plan outweigh its merits is a controversial point. Nevertheless this foreign practice affords an interesting comparison with our complex order of constitutions and laws.

**Influence of Statutes on Rule-Making.** Just as constitutions control the formulation of statutes, so the latter influence the preparation of administrative rules. For instance the Federal Board of Supervising Steamboat Inspectors is closely limited in the exercise of its rule-making powers by statutory specifications. Picking out inflammables for close examination, we find a congressional act of 1871 providing that baled cotton or hemp shall not be carried on passenger vessels unless the bales are compactly compressed, thoroughly covered, and secured "in such manner as shall be prescribed by the regulations established by the board of supervising inspectors;" nor shall strong acids be hauled on such steamers except on the decks or guards thereof or "in such other safe part of the vessel as shall be prescribed by the inspectors." Continuing its policy of minute intervention, Congress gave the supervising inspectors power to make rules regarding the carrying of petroleum products on steam vessels as sources of motive power for emergency wireless or ship lighting sets or for lifeboat propulsion. In 1918 Congress vested in the inspectors the power to make regulations regarding the transportation of kerosene and lubricating oils on passenger vessels, "whenever" these fluids were proved capable of withstanding a fire test of 300° Fahrenheit. Covering ships from stem to stern, everything from auxiliary steering gear and steam boiler fittings to fire extinguishers, Congress has laid out scores of petty rule-making jobs for the inspectors. As a result, these adminis-



trative officers are no more free to follow, in an independent way, the dictates of their own best technical reasoning than are legislators whose whole lives are spent under the limitations of restraining constitutions.

Occasionally, however, executive rule-makers are given ample freedom through blanket statutory grants. Where such is the case, they are in much the same position as a legislative body controlled by a short but general constitution. Most remarkable in this connection is the authority of the Aëronautics Branch of the national Department of Commerce to regulate air travel. Not only can this unit formulate any type of specifications it desires for the design of craft but it is in a position to issue whatever orders it pleases relative to traffic rules, pilots, and mechanics. Probably no other body is as free from the hampering effects of detailed superior law as this single extraordinary agency.

**Nature of Laws.** The law with which political science deals is quite different from the law with which engineering deals. The former is a rule of human action made by custom or by a deliberate determination of popular will or by a public agency duly authorized to enact law. The latter is a rule of nature outside of human affairs; it may be imperfectly known, obeyed, or disregarded (with various results), but it cannot be altered by any human contrivance. The law with which political science is concerned is not entirely independent of natural law: a legislature cannot, by resolution, make  $\pi$  equal three; but within the conditions set by nature, human agencies may prescribe rules of action for human beings, change them with more or less freedom, interpret them, enforce them, and secure more or less obedience under pain of penalties, such as fines and imprisonment.

These human laws, as we shall see below (pp. 175 ff.), are variously classified by lawyers for their purposes—into common or customary law and written law or into law and equity, for example. For particular ends, many of them purely

traditional, these classifications are useful, but no classification of laws has yet been made from the standpoint of practical engineering and economic purposes and operations. When such a complete classification is made, as is evident from even a brief analysis of state and Federal codes, both technologists and political scientists will be surprised at the results in terms of sheer bulk and significance for individual and social living.

**Law Analyzed with Reference to Technology.** Until this new consideration of law has been effected, we must be content with a mere index to the existing classification. The following tables give clues to the technological implications of state and Federal legislation. The first is a table of *The General Statutes of the State of Connecticut*, a state in which agriculture and manufacturing are combined. The statutes are grouped under sixty-one titles as follows, to which brief indications of contents are added:

General assembly	Taxation
State officers	Railroads, street railways, motor
State and state-aided agencies	bus companies, water, gas,
Buildings, institutions, care of	electric, and power companies,
property, and accounting con-	express, telegraph, telephone,
trol	and car companies (besides
Counties and county officers	other forms of property taxes)
Towns, cities, and boroughs	Highways, bridges, and ferries
Weights and measures, traffic	Motor vehicles
control, town plan commission,	Paupers
highways and bridges, zoning,	Humane and reformatory agencies
gas and electricity, fire, sewer,	and institutions. Institutional
and other districts	equipment and management
Elections	Penal institutions
Voting machines	Equipment and management
Militia	Civil service
Equipment, health, and sanita-	Agriculture
tion	Scientific grading of products,
Education	prevention of animal diseases,
Equipment, health, and sanita-	agricultural college, and experi-
tion	ment stations
Libraries	Parks, forests, and public shade trees

Miscellaneous state commissions	Limited partnerships
Oaths and official bonds	Drainage
State emblems	Negotiable instruments
Salaries and fees	Warehouses and warehouse receipts
Police power	Bills of lading
State police	Sales
Labor and factory inspection	Trade regulations
Public health and safety	Interest
Intoxicating liquors	Gaming and wagers
Examining boards	Trade-marks and labels
Medicine, surgery, dentistry, &c.	Hotel and inn keepers
Licenses	Probate courts and procedure
Cemeteries and crematories	Land and land titles
Reservoirs and dams	Eminent domain
Steam boilers	Mortgages and liens
Navigation	Lost and unclaimed property
Fisheries and game	Husband and wife
Private corporations and commerce	Regulation of employment
General provisions governing the	Courts
operations of great technolog-	Civil actions
ical corporations	Crimes
Public service companies	Criminal procedure
Banking	Provisions of general application
Insurance	

The following table gives forty-nine separate "titles" into which *The Code of the Laws of the United States of America* is divided by Federal authorities for convenience in use. The bulk of legislation involving technology in all its ramifications is immense and nothing short of an examination in detail can give a true impression of its magnitude and implications.

General provisions	Aliens and citizenship
The Congress	Army
The President	Bankruptcy
Flag and seal, seat of government,	Banks and banking
and the states	Census
Executive departments	Coast guard
Official and penal bonds	Commerce and trade
Agriculture	Conservation



Copyrights	Patriotic societies and observances
Criminal code and procedure	Pay and allowances
Customs duties	Pensions, bonuses, and veterans' relief
Education	The postal service
Food and drugs	Public buildings, property, and works
Foreign relations and intercourse	Public contracts
Highways	Public health
Hospitals, asylums, and cemeteries	Public lands
Indians	Public printing and documents
Internal revenue	Railroads
Intoxicating liquors	Shipping
Judicial code and judiciary	Telegraphs, telephones, and radio-telegraph
Labor	Territories and insular possessions
Mineral land and mining	Transportation
Money and finance	War
National guard	
Navigation and navigable waters	
Navy	
Patents	

### THE NORMAL PATH OF LEGISLATION

**Types of Legislative Bodies.** Excepting measures originated by the initiative (above, p. 72), statutes have their inception in legislative assemblies. Every unit of American government has such an agency (p. 96), which may be organized into either one or two chambers. Smaller areas, such as cities and counties, generally place their affairs in the hands of a single council or commission. Usually this body is compact, containing anywhere from five to twenty or more members. Our Federal Congress, on the other hand, consists of two parts rather than one—a Senate and a House of Representatives. In keeping with national practice, each of the forty-eight states has adopted the dual system of an upper and a lower house. Naturally, a larger number of legislators is necessary under the latter arrangement. The size of the state legislature varies from fifty-two in Delaware to the extraordinary total of 468 in the sparsely populated state of New Hampshire.

Where the bicameral arrangement prevails, certain dis-

tinctions are commonly made between the two houses. In the case of the Federal Congress, the Senate is smaller than the House, there being ninety-six in the former body and four hundred thirty-five in the latter. A second point of difference is in the basis for membership. The forty-eight states are allotted two Senators apiece, but a number of Representatives roughly in proportion to their relative populations. New York, with one hundred thirty-eight times as many inhabitants as Nevada, has forty-three times as many Representatives, but only an equal number of Senators. Nevada, obviously, is able to wield a much greater influence in one chamber than in the other. Finally, Senators hold office for six years as compared with Representatives who are chosen for only two years.

Once there were important distinctions between the chambers of state legislatures, based on property qualifications and other restrictions. With the passage of time, however, these differences have been largely eliminated. True, there are still a few cases of members of one branch being selected on the basis of counties or other political units, while members of the other branch are selected on the basis of population. But frequently both are apportioned according to population, with some recognition accorded to counties. Today about the only general difference is that the upper house is invariably smaller than the lower and in a majority of places the term of its members runs for a longer period. Taken by and large, then, the two houses have grown so similar that there is really slight justification for retaining the bicameral system. This fact is responsible for a few attempts to establish single-chambered legislatures, in Oregon during 1912 and 1914, in Oklahoma in 1914, and in Nebraska in 1934. About the only major excuse offered in defense of the present order is that one house serves as a check on the other, preventing precipitous haste in legislation. Even with that apology, there is some doubt as to whether the resultant lost motion does not more than offset any alleged benefits.

**Election of Members.** Members of legislative assemblies are everywhere elected. Representatives-at-large are chosen by the voters of an entire region, operating *en bloc*. Sometimes counties, towns, or other governmental units each choose a fixed number of delegates. Where population is used as a base, each group composed of a given number of people is entitled to a representative. As the regular local city or county lines bear little or no relation to the number of human beings within them, special districts of substantially equal population have to be marked off. Naturally, there is opportunity here for juggling lines so as to favor one party or the other—a practice known as gerrymandering.

**Origination of Bills.** Under the bicameral system, statutes usually follow a long and rocky path from the moment of their inception until the final hour when their fate is sealed. Measures originate in several ways. Perhaps a member of a legislative assembly has a pet idea, and draws up a bill on his own initiative. Again, it may be that some executive officer of the government, finding his way blocked by a legal obstacle, writes out a remedy. Or a special interest may suggest the wording of a favorable proposal. Finally the members of a committee (below) may put down their notions on paper. However started, a bill is read once in the particular house where it originates, is assigned a number, and is then referred to the proper committee.

**Bills Referred to Committees.** In the average legislature there are several "committees," each composed of a group of members devoting themselves to some particular subject. The California Assembly of 1927 contained fifty-four such units, many dealing with technical fields, including those on Drainage, Swamp, and Overflowed Lands; Irrigation; Manufactures; Medical and Dental Laws; Mines and Mining; Oil Industries; Public Health and Quarantine; Public Utilities; and Roads and Highways.

Proposals, on arriving before a committee, may suffer either of two fates. Frequently matters are "tabled" and



never taken up at all. For practical purposes they are killed and cannot be revived without extraordinary effort. A better future awaits others which are subjected to examination. Seeking basic information on the problems at hand, a committee may hold regular hearings at which interested parties are given an opportunity to present their special sides. When deemed advisable, important persons may be compelled to attend such conferences, by means of formal summons. To supplement the testimony gathered in this fashion, the committee may ask administrative officers or others for opinions and comments. With a collection of facts at its command, the committee then proceeds to pass judgment upon the measures before it. An item may be recommended for passage or for rejection as it stands or amendments may be suggested. At all events, the documents in the case, including the proposed bill, are at the disposal of the entire legislative body for further consideration.

**Passage of Bills by One Chamber.** Upon its return from a committee to the chamber in which it originated, a bill is read a second time. Then the measure is opened for discussion. Usually each member is entitled to a limited period in which to express his views, but in the United States Senate there is, ordinarily, complete freedom in this respect. In the course of the ensuing debate, a series of amendments may be suggested which may be incorporated in a revised proposal. Where changes have been drastic, it often proves advisable to send the new bill back to a committee again for further study and comment. Whether reexamined by the appropriate committee or not, the revamped measure is finally read a third and last time. Following this step, its fate is settled by majority vote. Because of the growing pressure of business before legislative bodies, expert committee opinions as to what should be done about a given item are likely to exert profound influence. Often the chamber as a whole merely sets its stamp of approval on committee recommendations.



*Photograph by Brown Brothers*

#### ENGINEERING IN THE DAYS OF THE CONSTITUTIONAL CONVENTION

John Fitch's steamboat, shown above, ran on the Delaware River during the national constitutional convention of 1787. While the trials were watched by a number of delegates, the committee writing a navigation clause for the constitution was too busy to attend.



*Photograph by Brown Brothers*

#### THE VETO DELAYS WORK ON AN ENGINEERING PROJECT

In 1928 Congress passed a bill providing for the improvement and extension of government operations at Muscle Shoals, but it was promptly vetoed. Not until 1933 was the plan revived (*see p. 357*). The above photograph shows the Wilson Dam and power house, vital features of the equipment at Muscle Shoals.



**Review of Bills by Second Chamber.** If a bill successfully passes one chamber, it is sent to the second. There it undergoes much the same routine. It is read once, referred to a committee, studied by the latter, and returned to the whole body for a second reading. Amendments may follow, there is a third reading, and finally a vote is taken. Several things may ultimately happen. The measure may be rejected in toto, killing it on the spot. On the other hand, the bill may be approved just as it arrived from the other house, in which case it is ready for executive consideration. Still a third possibility presents itself. Where the second chamber is neither firmly for nor against a proposal as submitted, it may amend the wording. If revised in this chamber, the bill is reported back to the house where it originated, to see whether the alterations are acceptable. If they are, then the measure is ready for executive review. If not, the time is ripe for trying to reach a formal understanding between the two chambers.

**Conference Committees.** Rather than have a measure indefinitely shuttle back and forth from house to house, with novel changes each time, it has become customary to speed up the process by referring differences of opinion to a joint "conference committee." This body, made up of representatives of both chambers, examines the issues at stake, and attempts to work out a compromise that will prove satisfactory to all parties. The resulting bill is, of course, submitted to both chambers for review. Usually they are tired of the battle and approve the plan without more argument. If they are still obdurate, naturally the whole affair has to be dropped, for the time being at least.

**Executive Veto.** After both chambers have formally approved the same measure, it is dispatched to the chief executive for his consideration (except in North Carolina, where the act is valid without any further steps).

Upon reception by the President of the United States or the governor of a state, a bill may be either signed or vetoed.

If signed, it becomes a law at once; if vetoed, it is returned for reconsideration to the house where it originated, unless the legislature has adjourned. The latter can, usually by a two-thirds vote, repass the bill, in which case, if also passed by the proper majority in the other house, it goes into force in spite of the action of the chief executive. Practice has shown, however, that the provision for an extraordinary majority ordinarily suffices to block any attempts to revive a vetoed bill. During 1923 some 1100 bills were disapproved by the several governors, yet only 104 triumphed over executive opposition.

Such is the regular routine, but special provisions apply to measures arising near the end of a session. A common rule allows the President or the governor a certain number of days in which to examine bills, after adjournment of the legislature. The fate of those he fails to sign varies. Some governments view unsigned measures as dead, by a "pocket veto," to use the language of the political scientist. Other units treat unsigned measures as effective, dating with the end of the period allotted to the executive for review. To the perils of the direct veto must be added that of presidential or gubernatorial neglect at the end of a session. Clearly the veto is a vital final step; it has defeated many bills.

Because of the importance of the veto, governors sometimes conduct hearings prior to exercising their high prerogative. When confronted in 1915 with an act for the taxation of "jitneys" or nickel fare autos, Governor Johnson of California invited representatives of both the motor-car people and the opposing trolley lines to appear before him. On one side stood street railway interests, seeking levies on "jitneys" as a means of reducing a novel but serious form of competition, already cutting into their revenues to the tune of approximately \$2,500,000 a year. On the other side stood the drivers, claiming that their earnings were insufficient to permit them to pay the contemplated taxes. Weighing the

several arguments, the Governor ultimately vetoed the bill. An alternative measure being subsequently sent to him, aimed at the same goal, he promptly disapproved it also. Final study by the governor, then, may be a very real part of the legislative process, critical, investigatory, and deliberative.

**Course of Bill Traced.** How rough the path of even a successful bill may be is indicated by the history of a California act relative to city planning. Introduced in the Senate on the 20th of January, 1927, it was at once referred to the committee on municipal corporations. Emerging from that body on the 14th of March, with suggested changes, it was briefly reviewed by the Senate as a whole and then returned to the committee. Eventually it came before the Senate a second time, being finally passed on the 4th of April. Traveling to the Assembly, it was turned over to the committee on municipal corporations, and reappeared with modifications only to be again committed to the same group. On the 26th of April it won the approval of the Assembly but in such a novel form that it had to go back to the Senate. The latter refused to accept the amendments, asking the Assembly to withdraw them, but the request was refused. As an only solution for the deadlock, a joint conference committee was empowered to develop a compromise, which both houses ultimately favored. On the 2nd of June the measure went into effect, with the governor's signature attached. Altogether four and one-half months had elapsed from start to finish.

**The Fate of a Session's Bills.** Mortality among bills is relatively high. During the 1927 session of California's legislature, 897 measures were introduced in the Senate. Approximately a third of them, 334 to be exact, entered committee doors never to return. Of those that did emerge, however, only five failed to pass. On arriving in the other house, ninety-three of these bills died, while in Assembly committee-rooms. Only seven survivors of the latter stage



failed to secure a favorable majority. When the final number of measures ultimately reached the governor, seventy-five were vetoed. So out of the 897 bills that started on their journey, considerably less than half ultimately became laws.

**Unicameral Procedure.** Naturally, law-making procedure is simplified where a legislative assembly has but one branch. In a typical unicameral city council, measures are introduced in the usual fashion, and then referred to appropriate committees. There bills are reviewed, being eventually returned to the entire membership for adoption or rejection. The absence of a second house eliminates further impediments, unless the mayor has the power to veto proposals. Simplicity and speed result.

**Joint Committees.** Some of the advantages of the unicameral system can be obtained through the adoption of a system of joint legislative committees. Under this plan, there is only one committee for each major subject, part of its members being drawn from the upper and the rest from the lower chamber. Bills wending their way through the legislature are simultaneously examined in committee by both senators and representatives so that a single set of hearings develops information for all parties involved. As tried out in Massachusetts, the arrangement seems to be markedly successful. Even where this scheme is impractical, matters can be much improved by giving committees in both houses the same names and jurisdiction.

**Constitutional Conventions.** Distinct from the agencies dealt with above are state constitutional conventions. As previously pointed out (p. 110), the constitution is the supreme law of the state, and a general overhauling is a task of the first magnitude. Theoretically, the "sovereign" people alone have the right to determine their basic form of government. Instead of entrusting the duties of revision entirely to their ordinary agents in legislatures, they often resort to the alternative of creating a special assembly. About two-thirds of the states definitely sanction this practice, with the re-

sult that over 200 such gatherings have been held. Actual calls for such a convention may originate in several ways. Sometimes it is provided that at periodic intervals, of perhaps twenty years, the voters shall be given the right to decide whether a new convention is to be held. Upon other occasions the people themselves, through the initiative (p. 72), or the legislature, may issue a call. When the proper steps have been taken, a preliminary commission may prepare a digest of the matters to be considered. At all events, on the appointed hour the convention comes to order. Invariably it is organized into a single chamber and operates through committees in drafting the several provisions and holding hearings. When the task is done, the proposed amendments or constitution, as the case may be, is usually submitted to the voters for approval.

**Charter Making.** A similar practice may be found in the case of cities where provision is made by the state constitution or state law for "home rule" in local affairs. Here municipalities are sometimes empowered to draw up and enact their own charters. Since a charter is a form of organic or fundamental law for the city, supreme over ordinances and administrative rules, the task of charter drafting, in such instances, is not entrusted to the city council, but to a special assembly. This assembly may be convened on an initiative petition (p. 72) filed by the requisite number of voters or on call by the city council, as the law may provide. As a rule the members of the city charter assembly or commission are elected by popular vote, although in some cities they are appointed. With a time limitation hanging over its head the commission drafts the charter for the city, dealing with its form of government and the powers to be exercised, and the completed document is submitted to the voters for approval. After a home rule charter has been adopted, it may commonly be amended on petition of the voters or by action of the city council approved on a referendum, as well as by creating a new charter commission. A

similar procedure for enacting county charters has been authorized in California.

### THE LAG IN LEGISLATION

**Are There Too Many Laws?** Having charted the routine course of legislation, we find it appropriate now to inquire into the volume of work done. History clearly reveals a marked growth in the annual output of statutes, running from colonial times to the latest hour. Viewing this expansion with alarm, publicists frequently declare that we are beset with the evils of "too many laws." Everywhere the cry is heard. Undoubtedly there is justification for the claim, in certain instances, but the fact must not be lost to sight that a very considerable increase is due to the needs of the present age. Inventions have been showered upon us thick and fast—railroads, steamboats, telephones, electric machinery, skyscrapers, automobiles, and airplanes, for example. New hazards to life and limb and opportunities for private gain to the detriment of the public at large spring out of the utilization of novel chemicals, tools, and machines, bringing in their train demands for remedial legislation. Legislatures therefore that seek to hold down their business to the simple transactions common many years ago, in order to preserve the tempo of our forefathers, are out of step with the twentieth century. We are getting more legislation, not merely because representatives are loquacious, but because it is necessary to safe and efficient living.

**Difficulty of Revising Constitutions.** Although the march of technology is continuous and irresistible, flowing from man's innate curiosity, law-making is generally done in fits and starts. The longest periods elapsing between legislative revisions generally occur in the case of constitutions and treaties. Although the increasing detail placed in some state constitutions has forced an acceleration of the amending process, it is still very slow. First of all, specific enactments retard modifications. Vermont, for example, forbids the



proposal of constitutional amendments oftener than every ten years and Tennessee oftener than every six years. A number of states provide that the question of a general constitutional overhauling shall be submitted to the voters at intervals of twenty years. Even if the path of an amendment were smooth, it would have to wait its turn. But the path of an amendment is far from smooth. Sometimes a proposition must be passed by two successive legislatures and then finally accepted by popular vote before it can become an integral part of a state constitution. So to actual time limitations must be added deliberately imposed checks as obstacles to the rapid, constant revision of fundamental laws. According to Walter F. Dodd, "in states that, like Vermont, Illinois, and Indiana, impose serious burdens upon the methods of constitutional amendment, detailed constitutions have imposed a substantially insuperable obstacle to progress in many directions."

**Treaty Revision.** A corresponding situation exists in the case of treaties. The convocation of an international assembly usually requires exchanges of diplomatic notes among interested governments respecting the exact time, place, and business of the meeting in question. Also, delay in securing the ratification of a treaty by many nations holds up the process. These facts are frankly recognized. In 1927 the International Radiotelegraph Conference met at Washington, D. C., to revise an earlier treaty. The delegates, being profoundly impressed by the phenomenal growth of radio since their previous gathering, feared that a rigid treaty might hinder the development of the art. As officially reported by a Federal department, "it was recognized as inadvisable to write into the regulations definite provisions of a technical or engineering nature which might become obsolete during the next few years. Instead, general provisions calling for the maintenance of a high technical standard were adopted. It is provided, for example, in Article 4 of the General Regulations, that the waves emitted by a station

must be maintained upon their authorized frequency *as closely as the state of the art permits*, and their radiation must be *as free as practicable* from all emissions not essential to the type of communication carried on." To the interested administration of each nation was assigned the task of keeping equipment up-to-date. As a rule, however, treaties are seldom so general in character and revisions are not easily or quickly obtained.

**Limited Length of Legislative Sessions.** Nor has the tempo of statute-making been increased to correspond with technological developments. Certainly all kinds of obstacles yet stand in the way of the expeditious transaction of business. Attempts have been made to hold down the volume of statutes by closely limiting the length of time during which assemblies may remain in session. Periodic, rather than continuous operation, is the rule. The Congress of the United States meets annually. As for the states, only six legislatures hold sessions each year, the remainder coming to order every two years, or, in the single case of Alabama, every four years. Furthermore, sessions are usually subject to mandatory termination at the end of a short run. In thirty-four states, legislative deliberations must cease upon the expiration of anywhere from forty days to five months, depending on the locality. Only in the municipalities, where city councils assemble regularly, is the process of law-making essentially uninterrupted.

Finding themselves cramped for time, law-making assemblies commonly push through an enormous volume of bills in the last few hours before adjournment. Specifically, in the first eight weeks of the eleven through which the New Jersey legislature sat in 1923, thirty-six bills were passed; in the next three weeks, 217. The corresponding Indiana body ground out 150 bills in the last two days of its 1917 session, as compared with less than fifty produced during early stages of its deliberations. Such pressure inevitably results in a mass of ill-advised measures. Governor Hodges,

describing conditions in Kansas growing out of haste toward the close of the 1913 legislative session, mentioned two laws duplicating two others; one law repealed three times; a new law immediately amended by a second law; an old law, repealed by a new one, amended and repealed by another; a law containing a negative reversing its purpose and a number of laws defective in their wording. Reductions in the time allotted to legislatures, far from fulfilling their purpose of cutting down the regular grist of statutes, may often merely lower their quality instead.

**Special Sessions.** Even the last-minute rush does not always clear up pending business. Often adjournment occurs before vital bills have been properly considered, perhaps creating a state of emergency. If the latter condition exists, resort to a special session may be necessary. The President of the United States, for example, has the power to assemble either or both houses of Congress on "extraordinary" occasions, regardless of the time of year. Similarly the governors of the several states possess authority to convene their respective legislatures, when necessary, by the issuance of a formal call.

Seeking to prevent the abuse of, and to limit, the privilege, a majority of the states require that the call shall mention in detail the matters upon which legislators are to act. Attempts to deal with subjects not listed in the notice are expressly forbidden, thereby preventing wasteful rambling and sometimes action upon measures urgently needed. Occasionally a governor may wish to widen the scope of his original order, after it is completed. To do this, he has only to ask for a second session, with broader aims, to sit simultaneously with the existing one, the two thereafter being indistinguishable. Under the above legal sanction, a great many extra deliberations have been held. The Federal Congress alone has had more than twenty gatherings of the kind, while the New Jersey legislature ran through four special sessions in the single year of 1931. The special session



may be an essential release from the hampering effects of time limitations on regular meetings but it does not cure all the defects inherent in short and periodical legislative operations.

**Lack of Quorum Prevents Action.** Still more could be accomplished during regular and special sessions if various rules of procedure did not stand in the way. A definite source of lost motion consists of the customary provision that a "quorum" must be present before a legislative body may transact business. Usually a "quorum" consists of a majority of the members of a given assembly, so that if half the enrollment is absent, final action on any measure is impossible. The latter state of affairs may be the product of mere accident. Representatives are frequently forced by the pressure of personal duties to be absent certain days. On the other hand, a minority may frankly seek to obstruct the passage of bills they deem undesirable by refusing to assist in the forming of a "quorum."

A favorite subterfuge, in former years, was for members of Congress, though present, to refuse to answer to their names when the roll was called. To overcome this trick of the trade, it has become the general policy to count all members actually present in the room, whether they wish to be counted or not. The chief recourse open to individuals, then, is to stay away from the legislative halls. If they remain in evidence outside, however, and circumstances demand drastic action, they may be legally arrested and brought to the chamber by physical strength, if necessary. But legislators cannot be pursued outside their own jurisdictions. Knowing this, thirty-four occupants of seats in the Tennessee House fled to Alabama in 1911, hoping thereby to block certain measures by breaking the quorum. Once at a safe distance from home officers, the thirty-four members expressed their intention to take a vacation along the Atlantic seaboard for an indefinite period. Slowly the deserters returned, however, and after the lapse of seventy days

work could be resumed. Of such serio-comic occurrences is the history of quorum manipulations composed.

**Filibustering.** To delays incident upon the absence of a quorum must be added those resulting from prolix debate. While the advantages of free discussion are many, oratorical opportunities may readily be abused. Speakers, if allowed as much time as they like, are in a position to block bills towards the close of a session, knowing that nothing else can be done until adjournment if their breath only holds out. Thus in 1903 Senator Tillman rose to address his colleagues, with a copy of Byron's *Childe Harold* in his hand. By threatening to read and read from that famous poem until exhausted, he forced his opponents to restore an appropriation item to a pending measure. In 1908 Senator La Follette, following precedent, retained the floor for eighteen hours, but finally yielded to his colleague, Senator Gore. The latter, after continuing as long as he was able, sat down, intending to relinquish his position to another ally, Senator Stone. Gore was blind, however, and did not realize that Stone was absent at the moment. In these strange circumstances, Gore broke the chain, bringing the filibuster to an end. In 1914 Senator Burton tried similar tactics, speaking for over twelve hours at a stretch, forcing weary antagonists to make changes in the River and Harbor Bill in accordance with his demands. Seeking to restrict such time-consuming debates, the Federal House of Representatives, along with most state legislatures, has placed a strict limit on the period during which a member may discuss a given bill. State rules commonly allow twenty minutes or a half-hour of comment per measure to each member, with a second, shorter period for concluding remarks or rebuttal. Limitations of this character certainly save time and expedite business.

**Friction between Legislative Chambers.** Still more fundamental, perhaps, in its dilatory effects, is the existing friction between the chambers under bicameral organization. Since each house has the power to "kill" bills duly approved

by the other, differences in point of view serve to retard or prevent the enactment of specific statutes. Owing to the divergent composition of the upper and lower bodies, the chances of deadlocks arising between the two agencies are excellent. Concretely, Senators destroyed sixty-two Assembly bills during the 1927 session of the California legislature, the Assemblymen retaliating by "burying" eighty-two Senate bills. Clearly there is much lost motion in the bicameral system. Many publicists, however, feel that the advantages outweigh the disadvantages. They hold that the check given to hasty, ill-considered law-making by the friction is far too important to be thrown away.

**Continuous Sessions Proposed.** Proposals nevertheless have been made for quickening the legislative processes more adequately to satisfy the needs of modern life. Robert Luce, for one, mentions the possibility of holding continuous sessions, thus doing away with present limitations. In support of his proposition he cites both the Continental Congress, which sat continuously during the Revolutionary War, and the existing city councils, holding meetings throughout the year. His suggestion, if adopted, might have several salutary results. There would be an increase in the time available to legislatures for drawing up measures. Bills could be prevented from dying on account of a last-minute failure to ratify, as adjournments for long periods would not occur. And if legislators were in continuous session or could be easily assembled on call, they would be in a position to take action the moment a novel situation arose. As matters now stand, marked technical progress may occur between sessions, calling in vain for legislative action.

**Elimination of Petty Details.** A second suggestion for expediting business centers about the transfer of details and rule-making in specific matters from legislatures to administrative bodies. At present a large amount of time is wasted in legislative assemblies on matters of slight importance, while vital issues drag.



The Congress of the United States, for example, has considered at length such matters as the following. One Angelo Cerri was the owner of a Jersey cow, pastured in an open lot in Connecticut. A group of Federal engineers, engaged in repairing a stream gauge, left some paint in the said field. The beast, being inquisitive by nature, wandered over to the container and attempted to consume the contents thereof. Although she was driven away several times by the engineers, her curiosity was only whetted the more. Finally she succeeded in evading the guards and swallowed the mixture. Naturally she died and Mr. Cerri sought compensation from the Government of the United States. A bill to reimburse him for the cost of the animal was introduced. In the debate on the floor of the House of Representatives the incident was reviewed, and one member, who evidently looked upon himself as a wit, laid emphasis on the fact that the cow might have been guilty of "contributory negligence." At any rate it took about \$3,500 worth of time for Congress to carry an appropriation of \$150 to compensate Mr. Cerri for his loss. A second item pondered by these solons about the same time dealt with the amount of money necessary to satisfy the owner of a Florida watermelon patch for losses incurred by him when soldiers stationed nearby raided his property. Others in a long list include an act to permit the building of a sewer line across a certain naval station and an act to consolidate the Turkey Thicket Playground. Then there is usually up for consideration in each session of Congress a flood of bridge bills dealing with the erection of structures over all kinds of rivers and creeks. Such items could be transferred to administrative officers, clearing the calendars for action on matters of importance that require public debate.

**Electric Voting and Roll-Calls.** Unique among all proposals for assisting legislatures to transact their business more expeditiously is the suggestion for electrical roll-calls. The present practice of reading names by voice, and waiting for a reply, both to ascertain the attendance and to take

votes, needlessly consumes time. The larger the membership, the greater the waste. Thus, in the Sixty-Second Congress the equivalent of fifty-five legislative days was occupied by the process in the House of Representatives, some forty-five minutes being required for each of 360 separate canvasses. In the Sixty-Third Congress, sixty-nine days were spent in the same fruitless manner. To obviate this practice, a small electrical device was built which would permit members to indicate their presence, or their vote on a measure, simply by operating one of three keys. The grand tally would then appear automatically on a central board. After investigating the novel system, a committee of the Sixty-Fourth Congress stated that "with a rule allowing a reasonable time for reaching the House from the Office Building, at least thirty minutes could be saved on each roll call." Applying the committee's figures to the Sixty-Second and Sixty-Third Congresses, we find that thirty-seven legislative days could have been saved in the former and forty-six in the latter if the apparatus had been employed. But Congress still adheres to its historic methods in roll-calling and voting.

#### OFFICIAL INFORMATION FOR LEGISLATORS

**Few Legislators Have Had Technical Training.** Technical competence must accompany speed in legislation, if the demands of the machine age are to be properly met. And yet rarely is the requisite competence represented in legislative bodies. Expert guidance must be sought elsewhere. A study of the biographies of the ninety-six United States Senators in January, 1932, illustrates the point in no uncertain terms. The great majority were lawyers. Apparently lawyers, if they have time to spare, are much more susceptible to political fever than any other group of persons. A mere handful of Senators had received scientific experience. One had served as City Engineer of Omaha and State Engineer of Nebraska. Another was a physician by profession and had formerly been Health Commissioner for New York City.

A well-driller, an aviator, a mining magnate, and two manufacturers swell the list. The remainder of the Senate, neither lawyers nor technicians by trade, comprised a scattering of bankers, farmers, teachers, and newspaper men. The situation in the Senate, moreover, is typical of conditions in state or local law-making units throughout the land; lawyers are there in abundance; technicians are not.

**Example of Technical Incompetence.** What may happen when legislators, without previous technical training, depend too much on their own knowledge and impressions is revealed in the case of the national radio law of 1927, already mentioned in another connection. By that act local broadcast facilities in the United States and possessions were equally divided among five zones. Power was apportioned among the states, territories, and dependencies on the basis of their relative populations. Now the amount of power needed properly to convey a program through the air is a function of the *distance* or area to be covered, not of the number of listeners or would-be listeners. By using population rather than geography as a basis, the law flies in the face of known physical facts. Unfortunate results are inevitable. An extreme example of the havoc thus wrought is afforded by Alaska and New York State. The former, with 586,400 square miles, is allowed a mere 0.38 kilowatts of power by the population rule, while the latter, with an area of only 49,204 square miles gets 35.10 kilowatts. The air in the New York region is jammed with signals: the Alaskans can hardly hear a sound. Any attempt to improve reception in Alaska, by permitting her to use more energy, would have to be accompanied by a corresponding increase in the assignments to New York State, creating perfectly intolerable conditions of interference there. This remarkable product of the lay imagination is more than a joke; it has warped radio development in this country for several years.

**Committee Specialization.** Obviously, there is genuine need for expert guidance in the formulation of legislation.



One important means of raising the level of statutes dealing with technological issues is afforded by the regular committee system, the general nature of which has already been described (p. 123). Members of committees, especially when they are selected on the basis of previous training, may be skilled in the subjects coming before them. In the Maryland General Assembly of 1929 a pharmacist appropriately served as chairman of the House Committee on Hygiene, while a physician was equally well fitted to occupy the post of chairman of the Senate Committee on Sanitary Conditions of the State. Even though their outside professional work has not given committeemen specialized experience, long service on the same committee is bound to render them increasingly familiar with its field of deliberative concern. Striking in this connection is the fact that in the Pennsylvania legislature one man served for thirteen sessions on the same committee, and that there were six cases of posts held for ten sessions, while persons serving for five or more terms were fairly numerous. It is in the committees, then, that we must look for technical competence.

Whether previously familiar with the field or not, committee members must supplement their knowledge. Consequently hearings are held on their special subjects, those relating to Boulder Dam, Muscle Shoals, and Flood Control on the Mississippi being illustrative. Voluminous indeed are the offerings of the experts who testify—one set of flood-control hearings alone filling some 2,000 pages. Among the persons presenting information, in the latter case, were the following: the Chief Engineers of the Illinois Central, the Missouri Pacific, and the Southern Pacific railroads; the Chief Engineer of the Division of Water Resources, state of Kansas; the Chief Engineer of the state of Louisiana; the Chief of Engineers of the United States Army; certain minor military engineers; the chief engineers of a few levee districts; and private consulting engineers. Expert opinion,

then, may be brought to bear on legislation through the regular committee system.

Being constituted for the continuous consideration of ordinary bills, regular committees do not always have time to study novel difficulties. Consequently, it has become customary to create special committees whenever the need for a piece of unusual research arises. Such a unit, for example, was established by the Federal House of Representatives on May 31, 1932, when five members of that chamber were charged with the task of investigating government competition with private business. As the final report was due on December 15th of the same year, the group had to act at once. Hearings were first held in Washington, D. C., at which disgruntled merchants and manufacturers presented their separate pleas. Complainants claimed that loss of trade resulted from the sale of goods by army and navy posts, the inroads of prison industries on legitimate factories, and other public activities. As letters poured in from far and near, demanding an opportunity to add further protests, the special committee finally adjourned and allowed its members to journey to their respective districts for the purpose of receiving arguments and pleas from interested parties in the several regions. After each member had collected testimony, the several "collections" were brought together and a summary report was prepared, dealing with the possibilities of enacting remedial legislation. Temporary agencies of this nature are to be found in state legislatures as well as in Congress.

**Reports by Executive Agencies.** Another method employed in securing technical information is to request an executive agency to investigate certain matters and render reports thereon to the legislature. Among the numerous documents prepared in response to congressional directions are many in the technical field. Thus a detailed analysis of the interstate movement of electrical energy was made by the Federal Trade Commission in accordance with a Senate order.

The study contains a map showing all crossings of state boundaries by high-tension lines, with a key indicating the voltage and company involved in every case. Total figures, showing that eight states exported and twelve imported over half their current, gave substance to idle discussions of the need for or the arguments against Federal regulation of interstate power operations. In compliance with a Senate resolution of 1929, the Department of Commerce prepared a booklet, entitled *American Branch Factories Abroad*, in which the effects of the branch factory movement on American trade are examined. The influence of tariffs, patent difficulties, transportation costs, and other considerations on the building of American plants in foreign countries is traced in detail, although the conclusions are lacking in scientific precision. Hundreds of reports, Federal and state, cover a wide variety of technological problems in government, furnishing a veritable mine of expert advice to law-makers.

Often regular executive bureaus and agencies are not equipped for the task of collecting data on new and peculiar problems. They may be so closely occupied with routine duties that they are unable to spare the time or furnish the staff necessary for a contemplated study, or they may lack technical competence. In such cases independent bodies are frequently created for the investigation of legislative needs in special fields. Among the latter may be mentioned the Tri-State Sanitary Commission. At their sessions in 1931, the legislatures of New York, New Jersey, and Connecticut passed resolutions authorizing the appointment of delegates to constitute this organization. The Commission was empowered to study water pollution in the metropolitan region of New York City, and was asked to develop a comprehensive program to control contamination in the natural waterways of the entire area. Finally, the Commission was instructed to draw up a tri-state treaty and to recommend any supplementary laws that might be deemed necessary to put the plan into effect.



In pursuance of the terms of these resolutions, the Commission was duly formed. To a subcommittee, composed of consulting engineers and experts representing state and city government health offices, was delegated the major part of the burden of conducting the inquiry and preparing the report. After a year of investigation the engineers presented a general relief program. Briefly, they set definite limits on permissible pollution for waters throughout the metropolitan district, according to the respective needs of individual sections thereof. Then they embodied their suggestions in a tentative treaty, providing that the same should be enforced under the direction of a permanent tri-state board. Having their specific recommendations in hand, the group met with legislative leaders in New York, New Jersey, and Connecticut to discuss the situation and finish the task of preparing appropriate statutes. Important services can be rendered to law-makers by the creation of such technical research agencies for particular problems.

**Powers of Investigating Bodies.** Exploratory organs, whatever their nature, may be granted broad powers for securing information. Private citizens can be ordered to testify before legislative committees, whether they wish to do so or not. A Federal instance lights the way. In 1927 the Supreme Court of the United States rendered an opinion in the case of *McGrain vs. Mally S. Daugherty*. The defendant declined to appear before a select committee of the Senate investigating the acts of his brother, Harry M. Daugherty, Attorney-General, and was taken into custody under a Senate resolution directing the Sergeant-at-Arms to bring him before the chamber. Shortly after he was arrested under this measure, the defendant was released by the District Court at Cincinnati on the ground that the Senate had exceeded its authority. On appeal the Supreme Court reversed the decision of the lower tribunal and in the course of a long opinion held that the Senate investigation was ordered for a legitimate object, namely, the performance

of a legislative function, that the witness had wrongfully refused to appear and testify, that he had been lawfully attached, and that the Senate was entitled to require him to give information. Later the power of Congress in this connection was reënforced when Harry Sinclair, leader in the oil industry, was sent to prison for refusing to answer questions respecting alleged frauds in the granting of oil leases by national authorities. Special agencies developing material for legislative bodies may be empowered to require witnesses to attend hearings, give testimony, and produce such relevant books and papers as are desired. Only through the sweeping use of such privileges was the Federal Trade Commission able to collect pertinent data relative to the methods employed by utility concerns in influencing popular opinion on governmental policies.

When investigating government bureaus, however, legislative research agencies may not have clear sailing. Being colleagues in the government service, executives are frequently successful in warding off intervention. Partisan appeals may be tried or resort may be had to the doctrine of the separation of powers. In 1909 the Federal Senate instructed the Attorney-General to inform it whether he had instituted proceedings against the United States steel trust for absorbing the Tennessee Coal and Iron Company in violation of anti-monopoly provisions of the law, and if not, why not. With customary bluntness, President Theodore Roosevelt ordered him not to reply, on the ground that "heads of departments are subject . . . to the direction of the President of the United States and to no other direction whatever." Again, administrators may oppose any move aimed at forcing them to turn over documents to legislative assemblies, on the allegation that many papers are confidential, and that to open them to the public gaze would be contrary to sound policy.

But these appeals are, as a rule, largely for sympathy. When a legislature really wants to act, it generally finds a

way to break through obstacles, except perhaps in matters involving serious foreign complications. Many drastic investigations of graft in high places have been made in spite of last-minute pleas. Notable in this connection was the Federal airing of "oil scandals" in 1923-1925 with a consequent shake-up in the Department of the Interior. In reality the separation of powers is seldom a serious barrier, for the legislature can alter or abolish administrative agencies by statute, or cut them off from funds if they become too obstinate.

**Legislative Reference Libraries.** Outstanding among the bodies which render assistance to law-makers are official libraries with agencies for legislative research. Through an exchange of current literature among these institutions, the experiences in the application of public policies by one government are made available for the guidance of other governments. When in quest of information on a particular subject, senators, representatives, or city councilmen themselves may, of course, use the library shelves. But with the passage of time it was realized that expert help was desirable. Consequently the Federal authorities, thirty-six states, and a number of cities have established organized reference services. Legislators wishing light on a certain matter have only to file a formal request for data with the staff of their particular service. Agents of the reference division then set to work, going through books, clippings, and other sources in a quest for information on given proposals, for pertinent statutes applied in other localities, and for miscellaneous data bearing on the problem in hand. A report is eventually rendered. Since legislators have only to write a brief note in order to put their hands on important materials, such library service tends to raise the general level of legislative competence in this country.

**Legislative Bill-Drafting Service.** Even with research reports before him, a legislator may not be in a position to draw up suitable remedial statutes. In the first place, his



knowledge of legal phraseology may be slight. Special skill is required to draft laws in such a manner as to accomplish precise purposes and to prevent ambiguity and loopholes. Furthermore, constitutions, charters, previous measures, and court interpretations must be often examined in order that a bill may pass the scrutiny of the lawyers. For a long time representatives were left to wrestle with these difficulties substantially unaided. With the passage of the years, and a tremendous growth in business before legislative chambers, it was finally recognized that organized and competent help was needed; so a number of units of American government have inaugurated "legislative drafting services." In making use of these institutions, a representative has only to describe roughly the general nature of the provisions which he wishes enacted into law. A trained draftsman then frames the bill with reference to law, facts, and ends. Any material that he may need in the course of his labors he can readily secure through the regular library staff. When completed, the bill is submitted to the applicant for review, and is revised if he so desires. The finished product is usually much superior to the home-made measures of inexperienced legislators. Our official libraries and drafting agencies, obviously, are a means of solving a part of the "expert" problem.

#### PRESSURES ON LEGISLATORS

**Types of Special Interests.** What are the motivating forces which set legislation in motion and influence its course? James Madison offers a key to the riddle. Every civilized society, he says in the tenth number of the *Federalist*, is divided into groups and classes possessing various kinds and amounts of property—landed, mercantile, industrial, creditor, debtor, and labor interests, for example. From different possessions and economic conditions arise different sentiments driving the people into factions, each bent on forcing government to do or abstain from doing something

deemed advantageous or injurious as the case may be. Although too simple and open to many exceptions, Madison's explanation is nearer the realities of American political evolution than the rival offerings. At all events if manufacturers demanding protective tariffs, steamship owners seeking subsidies, munitions makers in quest of contracts, job-hunters, and other interests of a practical character were withdrawn entirely from American politics, the substance of government would suddenly become much thinner. Politics is not all economics, but it is better illuminated by reference to that science than to any other. Certainly without economics, politics is a mystery.

Special interests (using the term in no invidious sense) often set up definite organizations for the purpose of directing legislation into given channels. Occasionally these bodies are temporary in nature, created to achieve a particular end. This may be illustrated. A project was launched a few years ago to force the adoption of bills transferring all Federal engineering agencies to a single central Department of Public Works. The movement had its inception, apparently, in a meeting of engineers, held at Chicago on the 19th of April, 1919. The efforts thus begun were subsequently expanded through the formation of the National Public Works Department Association. The membership of the Association was most comprehensive; at the first Convention, in 1920, representatives of engineering societies containing at least 100,000 members attended. Launching a vigorous campaign, the new propaganda unit asked engineers everywhere to lend their aid. Societies were lined up one after another—the National Federation of Construction Industries, for example, was brought into the movement. Although the engineers started off well, with plenty of enthusiasm, their interest soon waned; Congress lost heart; funds ran short; and the Association wound up with a deficit. To cite another illustration of a temporary body, less public-spirited than the engineers' organization, there was the

Cuban Sugar Lobby, "exposed" in 1929, a short-lived unit built up to work against impending increases in the tariff on imported sugar.

Where special interests must be constantly on the alert to favor or to protect themselves against legislation, permanent organizations are often created. Thus, the American Association of Engineers has formally announced its intention of continuously promoting bills favorable to the engineering fraternity. With the backing of some 25,000 members it has pressed for the adoption of a superior grade of license laws for technical men in the important states. The National Chamber of Commerce is provided with elaborate machinery for registering the opinion of businessmen on political issues. In addition, there must be included among the pressure groups the American Association of Railway Executives, speaking for all leading railroads, and units supporting programs sponsored by coal, fertilizer, wire, steel, express, and lime industries. The total list is practically a cross-section of our whole industrial structure.

Large sums of money are often spent in the process of influencing legislation. Many years ago the Pacific Mail Steamship Company alone was reported to have laid out over \$800,000 in order to win a Federal subsidy. Unfortunately for its designs, the annual appropriation of \$500,000 granted the concern was continued for only two years. So in the end the line made a bare profit out of the political venture. A considerable sum of money was laid out to pay for "assistance" in selling Alaska to the United States. In Massachusetts an elevated railroad measure was hastened through the legislature by the activities of thirty-five persons who received in compensation for their labors the sum of \$33,000. An insurance company spent in excess of a million dollars in ten years to secure favorable action on legislation. The list is long. Where important economic matters are at stake, though, it is not surprising to learn that funds correspondingly large go for attack or defense.



One marked difficulty, of course, is the fact that the strength of a lobby may not be in proportion to its merits. Large industrial concerns, with thousands of dollars at stake, can bear the heavy expenses of establishing powerful legislative agencies and are sufficiently well united to back them with vigor. Opposing individuals, such as consumers of electric energy, or scattered buyers of imported goods, may each have such small sums in jeopardy that they cannot afford to visit the capital in support of their interests. Although conceivably they might coöperate to engage spokesmen, the task of organizing masses of individuals is almost insuperable. So it may happen that one side will make an impressive showing at hearings while the other appears weak, even when the latter really has the better case.

Various remedies have been tried or suggested. For example, two private organizations have been created at Washington to protect the interests of citizens—the “People’s Lobby” and the “National Popular Government League”—both always on the alert to represent paying members, scattered throughout the country, when measures of interest to them are pending in Congress and before committees. It has also been suggested that a government officer be chosen to lobby for the people, this officer to be paid a regular salary for his full-time services. His position would be somewhat analogous to that of a district attorney who argues for “the public” against lawyers employed by the accused.

**Special Interests Draft Bills.** Many devices are utilized by these special economic groups to influence the course of legislation. Tracing the process from the beginning, we find them at work drafting bills and seeking to secure the introduction of their measures as drawn, if possible. A striking case of this sort was revealed in the files of the Rocky Mountain Division of the National Electric Light Association, now a matter of public record. The Division reported that the Association <sup>1</sup> had prepared a draft of a

<sup>1</sup> See footnote on p. 90.

model public-utility law, and that "the law has been turned over to the Public Service Commissioners Association which has promised to sponsor it, so it would appear that this was the work of the Commissioners Association rather than the utilities."

**Special Interests Watch Course of Bills.** When they are not engaged in drawing up bills, special groups are intently watching the course of measures sponsored by others. The nature of such a vigil is revealed in a letter written to a high officer in a branch of the National Electric Light Association: "Chairman Frank L. Smith, of the Illinois Commerce Commission, has announced that a bill will be introduced in the near future, making 'it unlawful for a utility company to attempt to divert excessive and unreasonable amounts to depreciation and other special funds for the purpose of evading orders for a reduction in rates' . . . I can imagine that such a bill might be a very dangerous one and certainly one which our committee would want to combat very strenuously."

**Testimony at Hearings.** When measures, good and bad, come before legislative committees, and hearings are held on the same, the opposing sides are given an opportunity to present their cases. And the opportunity is seldom slighted, where money is at stake. Testimony before the Federal Trade Commission reveals that Pennsylvania utility concerns once placed a substantial value on this step in legislative proceedings. From them one Mr. B. received \$1,250 as compensation for his services in appearing before a committee in connection with a giant power measure. Again, a Mr. S. was paid \$6,182 for work before a committee in charge of legislation affecting utilities. Often private interests openly appear before legislative committees through official representatives. Occasionally they prefer to operate behind the scenes. Thus a representative of an electrical association was once asked: "Would a person paid by your association go to the legislature and oppose a bill without

disclosing the fact that he was being paid?"—to which a frank reply was made: "Of course."

**Stirring up Constituents.** An effective method of influencing the rise and progress of laws is to "build fires" under legislators by stirring up their constituents at home. Several years ago one utilities agent wrote the following letter to a friend, relative to the ending of "unfair competition" between public and private engineering enterprises: "As you know, the Green resolution is about to be voted on in the House of Representatives. This resolution provides that tax-exempt securities issued by municipalities and states shall be no longer tax-exempt. You can realize the importance of the passage of this resolution as a constitutional amendment. It takes a two-thirds majority and may be acted upon at once. Therefore, quick action on your part is necessary. We find that Uncle Joe Cannon and Congressman King, of Illinois, are opposed to the amendment. I believe these men would listen to the voice from home. Can you arrange to have their friends telegraph them? This is quite important and I wish you would let me know what you accomplish." A rather cheerless letter was sent in return: "I am in receipt of yours . . . relative to the Green resolution, and I will bring all pressure to bear that I can on the persons you mention. These being old members, however, I doubt if pressure would be of very much interest."

**Key Men.** Men acquainted with government officials often serve as intermediaries in executing the designs of special interests. For example, a few years ago, an efficient Washington agent of an economic group was a former Republican Congressman of long service; his son-in-law held a post in the Treasury Department; his law-partner was once a Democratic assistant in the Attorney-General's office; and a brother-in-law of this law-partner was formerly a Republican member of the President's cabinet. Through one person, many crucial contacts could be made with the legislative and executive branches of the Federal Government. Gen-



erally, it is difficult to trace the thread of events. However, we do know that far back in 1872 the Pacific Mail Steamship interests sought to put through a subsidy bill by paying considerable sums to obscure employees supposedly possessing persuasive powers over Congress.

**Contributions to Campaign Funds.** Contributions to campaign funds may also indirectly affect the course of legislation, as Moorfield Storey once pointed out. "Many a man," he said, "who would scorn to receive a bribe, will accept a contribution to his campaign expenses, apparently paid for the honorable purpose of advancing a political cause, but spent in helping him to gratify his cherished political ambition by defeating now his rivals in his own party convention and now his political opponents at the polls. He does not recognise the bribe, but he feels the obligation to the contributor, and that gratitude which is defined as a lively sense of favors to come makes him glad to repay the favor if he can before the next campaign makes necessary a fresh call for pecuniary help. A man must be singularly independent if he does not lend a kindly ear to the friend who has helped largely to elect him and upon whose aid he must again rely." In fact, so anxious was one prominent utility head to win "a fair deal" for himself that he contributed to both the Republicans and the Democrats; under the circumstances he thought he could not possibly fail to gain his objective.

**Jobs for Friends.** Other circuitous methods may be employed to shape the course of legislation. Private interests have it within their power to make openings for retiring legislators in their concerns if they "vote right," or for their constituents at any time. Abuses of this nature became so numerous in Massachusetts that the state finally passed a bill imposing penalties on members of the legislature who attempt to obtain positions in public service corporations for friends.

**Bribery.** Actual cases of bribery are naturally hard to follow. Yet investigations occasionally disclose the existence

of corruption. One such study began in 1872. It revealed that a certain *Crédit Mobilier* Company had been organized "to skim financial cream" from the construction of the Union Pacific Railway. The process was this: the majority stockholders of the Railway awarded to themselves, as controllers of the *Crédit Mobilier*, a contract for building a substantial portion of the road on, to say the least, liberal terms. But progress on the whole enterprise depended upon Federal action, for Congress had to provide free land and other favors before a shovelful of dirt could be turned. In the circumstances Oakes Ames, being simultaneously a leader in the *Crédit Mobilier* and a member of the House of Representatives, sold to his associates in Congress many shares of *Crédit Mobilier* stock—at par. Since the price quoted on the open market for the stock was around \$200 a share, it was bargain day for all concerned. But the gift did not end here, for dividends to the amount of some 340 per cent were forthcoming within a year or two. Ames frankly selected the recipients carefully so as to put the securities "where they will do the most good." Of course, it is legally proper for legislators to buy stocks, but when the fate of their own enterprises is in their own hands, it would be strange indeed if they hurt themselves by indiscreet laws.

Since private concerns are in constant fear of governmental interference, advantage may be taken of their willingness to spend money for protection. An unscrupulous black-mailer in a legislature will prepare a bill capable of inflicting severe damage on a particular interest. This measure will be introduced for the prime purpose of forcing the party affected to buy off the originator and sponsors of the proposal. Slang expressions covering such items label them as "strike bills," "hold-up bills," "regulators," "sandbaggers," and the like. Occasionally, not one but a series of these measures will appear at a single legislative session—innocent in appearance and corrupt in design.

**Direct Approach to Legislators.** Legislators may be approached directly. The process is illustrated by the history of the 1920 convention of the National Public Works Department Association. One morning the various state delegations to the meeting devoted their time to calling upon representatives in Congress from their respective localities, with a view to fostering a Federal public-works department measure. Since agents of special interests make a habit of sitting around in waiting-rooms or "lobbies," these men have won the appropriate title of "lobbyists." Occasionally, however, the name is a misnomer; for sometimes they are not content to cool their heels in ante-chambers. Hichborn avers that in 1907 outsiders boldly marched into the chambers of the California legislature during open sessions. Moving from desk to desk, during the transaction of business, they tapped the shoulders of Senators and Assemblymen in directing their votes. In a subsequent year one offender of this type became so persistent that he was ejected bodily from the hall. As a general thing laws exclude lobbyists from the floors of the legislature, forcing them to wait in corridors and doorways and buttonhole members as they move in and out of the building. The more expert lobbyists doubtless take advantage of other occasions.

**Control of Lobbies.** Evils attending pressure upon legislators have brought an inevitable reaction in the form of statutes. Massachusetts attacks the problem by providing that men hired to work for or against bills must register their employment in advance, and at the end of each session must report the sums received as compensation. Wisconsin also attempts to regulate the process by forbidding lobbyists to influence legislators personally and directly, other than through the channels of written statements or committee hearings. So progress has been made towards the recognition of special interests as legitimate parts of the political process, as long as secret tactics are not employed; but no satisfactory solution of the problem has yet been found.



**The Pork-Barrel.** Internal, as well as external, forces are at work on legislation. Influential in its effects upon the ultimate passage of certain engineering bills is the so-called "pork-barrel." The several members of a legislative body, being elected by geographical units, are prone to seek assistance for their own constituents. Thus they are frequently led to favor the construction of public works—such as river and harbor improvements, buildings, or concrete roads—in the districts they represent. Making concerted efforts to "raid" the treasury to help the business of "the folks back home" is labeled pushing "pork-barrel" legislation. The title is derived from an old Southern custom of allotting a certain amount of pork to the slaves periodically; at the appointed time the pork-barrel was rolled into view, the head knocked in, and the contents distributed among eager beneficiaries. The applicability of the figure of speech to the above phenomenon needs no elucidation.

**Log-Rolling.** A legislator, when asking favors for his constituents, must usually obtain the good will of his fellow members in order to achieve his goal. To do this, he may offer to support measures of friends, obligating the latter to further his own schemes in exchange. Mutual aid of such a character bears a quaint title—"log-rolling." In former times, pioneers on the frontier helped one another cut trees and pile up logs for the construction of cabins, or for burning in "clearing" land. The rolling of the logs by common labor forms the basis for the above political terminology. Akin to bribery, the custom is forbidden by law in a few states; but the practice is still general.

**Party Organization.** Party organizations also affect the fate of measures in legislatures. Naturally the majority political group holds the whip-hand. Not only can it control bills as they come up for a general vote in each house, but it also directs the course of important committees. True, minority men are on these bodies but they are, as a rule, so outnumbered as to exert little weight. Of course, party

lines are not perfectly rigid. Indeed "blocs" are occasionally formed to support specific policies, irrespective of party affiliations. Nevertheless partisan politics is usually in evidence even when purely technological matters are up for consideration. In the best of circumstances it is difficult to secure a consideration of legislative proposals on their purely technical merits.

### ADMINISTRATIVE RULE-MAKING

**Single Officers *versus* Boards as Rule-Makers.** From law-making by representative assemblies we now turn to the problems of legislation by administrative agencies. It is true that laws made by such agencies are not called laws by jurists but are treated as rules, decrees, or regulations. The engineer is not apt to detect any marked difference in substance. Both types of laws are binding but often the administrative order is more important to him than the statute, since the order is likely to govern technological performances in minute detail.

Two prime types of organization are to be found engaged in the preparation of administrative regulations—boards and single officers. Many cases may be cited of the former system. Orders governing the construction and operation of American vessels are prepared by such a group. It consists of the Supervising Inspector-General of the United States Steamboat Inspection Service and eleven subordinate supervising inspectors, each being in charge of a particular geographic district. So, too, the Federal Power Commission, comprising five men, draws up directions relative to hydro-electric development on certain streams. In addition there are state health bodies, engaged in promulgating sanitary rules. And the list might be continued indefinitely. It is argued in favor of the board system that the various members will each bring to current problems his own point of view, or special interest, thus effecting a well-balanced compromise, adjustment, or decision.

Greater simplicity and directness are achieved by the alternative scheme of placing rule-making powers in the hands of a single executive officer. Connecticut's Commissioner of Motor Vehicles has control over the preparation of regulations relative to automobile brakes and headlights. The Federal Secretary of Agriculture is vested with the authority to set up standards for rosins and other so-called naval stores. Where a competent man is in charge, and he takes pains to hear and examine the views expressed by both sides relative to a given problem, the individual plan has its advantages. There is no haggling among board members, no shifting of responsibility, no lost motion. But where an incompetent or headstrong man holds sway, a miniature dictatorship may be erected, supreme except upon appeal to a superior agency or the courts—an appeal likely to be expensive and to delay operations.

**Rule-Making Procedure.** Whether rules are prepared by a single officer or by a board, procedure is much the same. Current problems are considered at convenient intervals. Often the frequency of revision is left to the determination of individual administrators. When such is the case, various private groups affected by constant alterations are naturally continuously on edge for fear that revolutionary changes may be announced at any moment. Consequently, it has sometimes been the policy of rule-makers voluntarily to put limits on their own authority by promising that shifts will be made only at definite intervals. To illustrate: when the Aëronautical Chamber of Commerce met at Cleveland, in 1929, it was evident that there was a general desire for stability in national aviation requirements. Various manufacturers expressed themselves as wishing to be safeguarded against sudden modifications of aircraft design specifications which would upset production schedules. The criticism was taken to heart by the Chamber, which extracted from Federal agents a promise to issue revisions of requirements respecting air-



worthiness but once a year, effective from each January the first.

But administrative rule-makers are not always in a position to decide upon the proper frequency of revision. The Board of Supervising Steamboat Inspectors is required by statute to meet on a specified day each year. It is in much the same plight, then, as regular legislatures constrained to the holding of sessions at fixed intervals. As is to be expected, important developments come up between conferences, necessitating the calling of "special sessions." To deal with such contingencies, the Secretary of Commerce is empowered to form hurriedly an "Executive Committee." This body consists of the Supervising Inspector General and any two supervising inspectors who can be obtained on short notice. Upon organization, the small group draws up emergency rules to cover the crisis at hand, rules which continue in force until after the close of the next succeeding routine annual meeting of the entire supervising staff of twelve.

When the time is ripe for action, hearings are commonly held as a basis for the development of rules. Insight into the working of these conferences may be had by reference to the records of the Federal Power Commission. This body was faced with the task of setting up a mass of regulations governing the development of hydro-electric projects on major interstate streams. First tentative drafts were prepared and then a general announcement was made to the effect that full opportunity would be given to all interested parties to present pleas at a subsequent date.

The contemplated review was made on August 12th and 13th, 1920, at which representatives of the National Electric Light Association, the Electric Bond and Share Company, and others were present. As an outgrowth of the gathering, a consulting board of men from the National Electric Light Association was formed to assist the Commission in the work of revision. After fairly definite conclusions had finally been reached, they were sent to the Engineering Council

of America for study as to policy. On the opposite side, agents of the Federal Government interested in public health, Indian affairs, forest preservation, and other functions were interviewed to obtain checks on the proceedings. On the basis of all previous criticism, the first regulations were ultimately approved by the Federal Power Commission on the 3rd of September, 1920. The path of certain financial specifications was not so smooth, for a series of meetings were held before they were formally put into force. Much the same practice prevails, then, as in legislative assemblies where proposed bills are referred to committees which usually call hearings. However, board members are likely to be more highly trained in their particular fields than committeemen and, therefore, more competent to obtain technically sound results at conferences. There is, of course, no guarantee in either case that public interests will be served.

After approval by an administrative officer or commission, rules are ordinarily considered to be in effect. However, there are exceptions. To cite a specific case, the regulations adopted by the Board of Steamboat Inspectors are transmitted forthwith to the Secretary of Commerce, the head of the Federal department involved. Unless and until he agrees to the provisions of the same, such orders remain inoperative. Here we have the phenomenon of the "veto" again, an executive agent supporting or destroying measures prepared by a deliberative assembly. Thus the mimicry of legislative procedure is carried further into administrative rule-making.

Since administrative officers are engaged in the enforcement as well as the preparation of regulations, any weaknesses developed in the rules are likely to be brought to their attention. Prompt initiation of revisions is thus made easy. To illustrate: there were three major marine accidents on Lake Michigan during 1929. First the *Andaste* sank with a crew of twenty-five; a month later forty-seven lives were lost when the car ferry, *Milwaukee*, mysteriously disappeared;

finally nine went down with the *Kenosha*. The Supervising Inspector of the Steamboat Inspection Service made a careful study of all three mishaps, suggesting to the 1930 meeting of the Board three changes in existing rules, all of which were approved by it. These alterations demanded the submission of blue prints to the Government prior to the approval of new ship construction or of plans for rebuilding; the carrying of life-rafts in addition to lifeboats on Great Lakes craft; and the placing of extra distress lights on larger Lake vessels. A similar check on design orders is afforded by the Aircraft Accident Board, which points out weaknesses in present aeronautical requirements for the guidance of aviation rule-makers in the national Government.

**Special Interests Exert Pressure.** Special interests may exert pressure on administrative agencies with a view to changing rules, just as they influence legislation. A case in Michigan proves the point. There a State Board of Aeronautics drew up regulations, effective on March 1st, 1930, controlling a wide range of flying operations. Shortly after the requirements went into force, the Michigan Aircrafters Association became active. Comprising a majority of the operators, pilots, mechanics, and flight instructors in the state, it held a meeting in Detroit on the 22nd of March. A resolution was adopted condemning the orders as restraining aviation progress. On the other hand, the director of the Board of Aeronautics said that "the State Board and myself as well as my entire staff are open-minded and willing to make any reasonable changes that will tend towards placing aviation on a safe and sound basis, but we will not listen to any selfish arguments. We have designed our rules as near as reasonably possible after a set of legislative laws, but if we are working along too stringent a line on some of the rules we stand ready and willing to change them."

The result was a partial victory for the industry, since the Board ultimately altered its rules. For example, the flying of planes from unlicensed fields ("barnstorming," in the



vernacular), though prohibited by the original code, was permitted in the revision. Also, instead of requiring schools to maintain one airworthy plane per fifteen students, as in the initial specifications, the altered rule merely demanded that at least two airworthy planes be kept in readiness at all times, regardless of the number of students. Special interests may mold rules as well as legislation.

Means of exerting pressure on executive agents are in some respects different from those utilized in dealing with legislative assemblies. As administrators are usually appointed, rather than elected, they have no constituents to fear. Neither the opinions of the "folks back home" nor the necessity for campaign funds to retain their posts are matters of immediate concern to them. But even so, many rule-makers are not totally independent, especially when outside of the civil service and, therefore, compelled to listen to voices from above. If the favor of a higher official can be won, a threat of removal may lead subordinates to a quick revision of plans. Furthermore resort may be had to the legislature which can, of course, cancel any administrative requirement by passing a nullifying statute.

Still other and more subtle forces are at work. Shifts are constantly being made from government to private employment. Naturally, a man familiar with the details of regulatory machinery is capable of rendering great assistance to private industries. A strict and unyielding attitude towards companies subjected to his orders is apt to shut the doors of personal advancement in the face of the "hard-boiled" administrator. Moreover, even though he expects to remain in the public service, a rule-maker does not like to be greeted with angry looks every time he visits managers in the course of law and rule enforcement. So, because of their close contact with the world of private technology, administrators are likely to respond to changes in the operating conditions of the public and private enterprises under their jurisdiction. They find their tasks difficult in

the most favorable circumstances and unless they have a strong sense of public responsibility they may easily slide into practices that are questionable, if not worse.

**Administrative Rules as Basis for Subsequent Statutes.** Occasionally administrators, when formulating rules, are really serving as exploratory agents for legislative assemblies. For instance Congress, being technically unfitted for the task of setting up standards for a variety of farm products, delegated this duty to the Secretary of Agriculture in 1903. After extensive research, the latter officer promulgated a series of requirements. As experience was gained in the field, revisions were made until certain regulations were whipped into workable shape. When Congress believed that the time was ripe, in 1923, it approved a bill enacting one of the standards into law. There are advantages in this process. Administrative rules, as pointed out above, are highly flexible and can be altered on short notice. After use is made of this feature to develop regulations that are enforceable, stability may be achieved by raising them to the rank of statutes. Rule-makers thus may serve as laboratory assistants for the testing of novel policies.

**Publicity and Codification.** In closing this chapter on law and rule-making, we should mention publicity for the finished product. Theoretically, ignorance of the law is no excuse for violation. It is assumed by the courts that everybody should be, by some subtle magic, immediately aware of the existence of every new act or rule, but this is unfair to the layman. In the first place, few people are in a position to keep watch on the stream of legislation. Even if they honestly try, obstacles stand in the way. Printed copies may not be available until after a statute is in force. Often administrative rules are never printed but merely issued in typewritten form, so that it is difficult to secure copies.

Even if laws and rules can be easily obtained, they may be utterly devoid of systematic classification and almost

useless to the untrained citizen with little time to spend in research. Still there are exceptions. Most governments sift and compile their statutes at intervals, when the spirit moves, and provide adequate indexes. There is even one instance of a state, Wisconsin, that continuously codifies its laws. As laws and rules grow in number and complexity the urgency for constant classification, indexing, and systematization through cross-references will increase. Efficiency calls for action in making laws and rules more available to parties affected by their prescriptions.



## CHAPTER VI

### JUDICIAL PROCESSES OF LAW ENFORCEMENT

**Difficult Nature of Enforcement.** The formulation and enactment of constitutions, statutes, and administrative rules, despite the difficulties involved, are relatively easy exercises of the mind. In comparison, the interpretation and enforcement of law are complex operations involving acts of will and physical power on the part of public authorities as against thousands, perhaps millions, of citizens, in their diverse relations. It is a simple matter to decree that the rates of a public utility shall be reasonable. To examine the plant of the utility, its operating costs, and its financial set-up, to determine the "reasonableness" of any given rate, and to compel the utility officials to obey rulings are operations of enormous complication. In the latter case the meaning of the law must be made clear in terms of positive acts to be performed by the private parties concerned and special orders must be issued against those who refuse to obey.

**Judicial and Administrative Enforcement.** Although it is customary to speak of the courts as especially charged with law interpretation and enforcement, it is pertinent to recall that executive or administrative officers are likewise charged with interpretation and enforcement. As far as the citizen is concerned there is no substantive difference between a court order compelling him to perform a certain act and an administrative order giving him identical instructions. To him the nature of the act to be done and the compulsion applied are the prime considerations.

In the light of engineering rationality, there are few operations in law interpretation and enforcement performed by courts which are not also performed by numerous administrative officials. Courts interpret law; so do the latter. Courts set aside laws on the ground that they violate superior law; so do administrative officers. Courts hear cases of persons accused of violating law and impose penalties; so do administrative officers. From the interpretations and orders of lower courts appeals are taken to higher courts; in many cases appeals may be taken from administrative subordinates to their superiors. Courts may declare laws unconstitutional; state governors and the President of the United States may veto bills when they believe the said bills to be unconstitutional. Viewed practically, the courts are merely one group of public authorities engaged in the interpretation and enforcement of law. They have a special name—the judiciary; and the distinction between them and executive authorities is formally recognized in law and procedure.

**The Courts and Engineering Issues.** In various ways the work of the courts impinges upon the work of the engineer. They interpret the laws which he must obey and issue orders calling for obedience. They may encourage, retard, control, direct, or block him in his undertakings. To them he may appeal for relief against doubtful laws, ordinances, or administrative orders. In many cases, they are the last resort for the settlement of disputes. Before them he may be brought for failure to interpret the law as applied to his work or for neglect to apply the law. It is, therefore, important that the engineer, in common with other citizens, should know something about the organization, procedure, and powers of courts, which he may use in case of need. This chapter is merely intended to serve as a guide to the study of law interpretation and enforcement by the judiciary—not to obviate the necessity of obtaining the advice of a lawyer when particular difficulties arise.

## TYPES OF CASES AND LAW INVOLVING ENGINEERING

**The Nature of Court Actions.** Courts act only on particular cases and individual applications. Although they do in fact make new law by interpreting old law, they do not, like the legislature, formulate and promulgate sweeping policies without respect to cases before them. Although they enforce law, they do not go out, like administrative officers and inspectors, and find violations of law or compel obedience by specific instructions, on their own motion, to persons concerned. They deal only with cases and applications brought before them by private parties and public officers. What is a case on which a court can pass? It is an action brought by some party to the attention of the court. Who may bring actions at law? Any private person or corporation may bring an action against another private person or corporation or against a government body or officer, with some exceptions. Again, a government authority may bring an action against some private person or corporation. What is the nature of an action at law? There are two kinds: civil and criminal. A civil action is one in which a court is called upon, at the request of a private party or government officer, to decide a dispute over property or personal rights and obligations. A criminal action can be brought only by government against a private party charged with violation of criminal law (below, p. 167). Now the materials, machines, patents, devices, and other things with which technology works are forms of property over which disputes respecting rights of ownership and use may arise between various parties, for example, does this patent belong to A or to B? Has this city, in taking over the electric plant of that company, made due compensation as required by law? Controversies over such questions may be taken into the proper court as cases for hearing and decision.

**A Type of Civil Action.** Where any party believes that he has been wronged by the action of another party he may



turn to the civil courts for relief. Contracts are a fertile field for dispute. Recently two inventors, for example, conceived a design for evading the American tariff. It seems that Cuban raw-sugar syrup could be imported into the United States in a 68 per cent solution without suffering serious loss from fermentation. Syrup of such concentration paid a duty of \$40 a ton. But the two inventors developed a method for converting 68 per cent syrup into 48 per cent syrup on board ship, prior to entering port—while still sufficiently beyond the three-mile limit to escape American jurisdiction. The diluted sugar could be readily rushed to port before it spoiled, saving \$39.17 a ton in taxes. The company employing the device, the inventors alleged, failed to pay them the royalties agreed upon and they brought suit to obtain their money.

**Crimes and Penalties.** A second class of cases at law involves offenses against the government. In such cases government officers lead as accusers and prosecutors. These offenses range in gravity from cold-blooded murder to mere misdemeanors, such as driving a locomotive across a public road without blowing a whistle. They are usually lumped together as crimes, even when they involve no serious moral turpitude but are the results of mere ignorance or inadvertence. As a matter of fact some of them are subject only to civil penalties, such as fines or loss of license, and come before administrative bodies instead of courts.

In view of the enormous mass of penalizing statutes, rules, and ordinances which confront the citizen today, the chances of breaking laws are almost infinite. Take for instance the matter of smoke control. New York City reports the trial of eighty-nine cases of alleged disregard for local rules in a single year, a number of offenders paying fines running from five dollars to one hundred dollars. Aëronautics too brings its regular crop of petty violators of law. In the year closed June 30, 1930, forty-two individuals were penalized for unwarranted acrobatics, nineteen for low flying, three for

flying without navigation lights, five for flying without license numbers, and forty-two for flying without pilot's licenses. Overtime parking, neglecting to obey traffic signals, heading in the wrong direction on one-way streets, driving at night with headlights out of commission, operating with defective brakes, and other misdemeanors help to keep the automobile traffic courts busy. Failures to observe building codes, to follow steamship or railway-car design rules may all have unhappy endings. Numerous are the potential contacts of citizens with the courts in the machine age, arising out of disregard for government rules and regulations. They involve almost every phase of our complicated modern life.

**Cases Involve Law and Facts.** In every case before a court both law and facts are drawn into the controversy and bear upon the decision to be made. For example, John Smith, a farmer, claims that a railroad company, in building its line, has taken more of his land than it has a right to take and sues the company to recover the portion of land in dispute. What law is applicable? The company cites a statute of the state clearly empowering it to condemn land for its purposes as far as may be "necessary to the operation of the railroad." There stands the law. It is clear—on its face. Facts are next in order. Is the piece of land which the farmer claims actually "necessary to the operation of the railroad?" This question can only be answered by an examination of the location of the land and its relation to the requirements of railroad operation. Here the case must be determined by purely technical considerations of railroad operation. The law means in reality only what the technical facts permit it to mean in this particular instance. This is only one example—and a very simple illustration besides—of the thousands of law cases involving technological points.

**Validity of Legislation.** In connection with discovering the law applicable in any case before it, a court is often called upon to decide whether the law which one of the liti-

gants relies upon for his argument is actually law, is valid; that is, does not conflict with some other and superior law (see Chapter V). Thus, for instance, the South Carolina Power Company was once faced with the necessity of paying a tax on every kilowatt of electricity sold in South Carolina under the terms of a new statute enacted by the legislature. One fact was clear: the Company was selling electricity in the state. There was no doubt about that. But the Company was importing current from the neighboring state of Georgia, and under the Federal Constitution, the supreme law of the land, the regulation of interstate commerce belongs entirely to the Congress of the United States. So the Company contended that the law of South Carolina laying the tax was "invalid," that is, contrary to the superior law, the Federal Constitution. South Carolina could not tax interstate commerce. That was clear. Here a question entered the case. Was the electricity which the Company sold in South Carolina an article of interstate commerce imported from another state?

In answering this question, the court before which the dispute was brought went into the technology of electrical production, and in arriving at a conclusion laid stress on the physical nature of transformers, among other things. Current transmitted by the Company from Georgia into South Carolina is at high potential. In South Carolina this high voltage passes through one winding of a transformer, inducing in a second but separate winding a low voltage current suitable for subsequent distribution to customers. Now the current generated in the secondary of the transformer, said the court, "resulted from the use of the original current but is not that current, just as current produced by steam results from the use of coal but is not the coal." The statute, since it taxed only the induced current sold to customers, levied on a new and different current from that passing in interstate commerce. Hence, concluded the court, the state law does not run counter to the Federal Constitu-



tion. Here we see a decision as to validity turn upon the technology of electrical production and distribution.

Contests over the validity of laws and administrative rules may run from localities all the way up to the national Government. The validity of a city ordinance may be challenged on the ground that it violates the city charter or a state law or even the Constitution of the United States. An act of a state legislature can be set aside if it runs counter to the constitution of the state or the Federal Constitution or laws. If a bill enacted by Congress is not authorized by the Federal Constitution it may be declared invalid by the courts through formal judicial process. Likewise administrative rules, which are so often of vital importance to the engineer, may be tested in the courts to discover whether they conform to superior laws and constitutions under which they were made. For example, if the Board of Steamboat Inspectors makes a rule respecting some phase of steamship design, that rule may be challenged by the parties affected and the case carried into the proper court for the purpose of discovering whether the Board was within or beyond its powers in issuing the rule in question. A new law or rule is, therefore, not automatically binding on all parties concerned; its validity can always be questioned and referred to the proper court for review, subject often to appeal to higher tribunals.

**Interpretation of Legislation.** Even if a given law is clearly valid in principle, its exact meaning may still be obscure. Disputes over the specific *interpretation* of laws constitute another great class of cases coming before the courts. An interesting illustration of the interpreting process and its results is afforded by the history of musical copyrights. Under the national Copyright Act of 1891, composers were enabled to secure government protection against the unauthorized reproduction of sheet music. In the years immediately following the passage of this statute, the phonograph and player-piano became generally popular. The new

industries, by refusing to pay tribute to composers or to respect their copyrights in any way, incurred the wrath of the latter. Seeking to win compensation from their mechanical rivals, sheet music companies brought suit in the courts. The judicial mind was, forthwith, called upon to find the correct definition of the word "reproduction" as applied to sheet music. Records and rolls, according to the judges, were not "reproductions" of sheet music, but were entirely different articles. Briefly, the decision withdrew from the music-writer all protection against the mechanical trade. Phonograph and player-piano concerns, released from all legal obligations to composers, grew by leaps and bounds, to the detriment of the latter.

For the purpose of according to composers their just dues a new Federal copyright law was passed in 1909. Under the provisions of this act, manufacturers of mechanical musical supplies are required to pay the originator of any tune used by them a total of two cents for each record or player-piano roll copy made of the same. From the makers of phonograph records, which reproduce simultaneously both the music and the words of a song, composers receive only the statutory two cents compensation per record. With the piano, the situation is different. On account of the fact that pianos are incapable of reproducing words, player rolls can serve as a mechanical source of music alone. For the privilege of perforating melodies on their rolls, makers pay the regular two cents per copy as a fee to composers. In order, however, that the words may be available to singers who wish to accompany the piano, script is often printed on the paper rolls. As interpreted by the courts, this publication constitutes a clear-cut "copy" of sheet music, under the Copyright Act of 1891, roll manufacturers being required, therefore, to pay an additional royalty in such cases. The total composer's fee on a roll then is approximately ten cents for words and tune as compared with two cents for the same on phonograph records. The differential exist-

ing in favor of the phonograph resulted, it was alleged before a committee of Congress, in the bankruptcy of several player-piano roll companies. Evidently the exact twist given to the law by judicial interpretation may vitally affect technical work in manufacturing.

**Injunctions.** It is not always necessary to wait until after damage is done before going to the courts. Sometimes prospective injuries can be forestalled by means of a judicial decree called a "bill of injunction." Such a bill orders a party to keep from performing specified wrongful acts for which there would be no adequate legal remedy. The weapon has won prominence in labor disputes and a striking example is to be found in a decree issued by the Federal court for the southern district of Ohio against the United Mine Workers in 1927. In this instance the Federal judge, besides forbidding the officers and agents of the trade union in question to resort to violence, commanded them not to do "anything" designed or intended to interfere in any way with the mine owners or their employees or any persons having business with them. Not content with this general interdiction, the court went on to mention a number of particular actions which were to be construed as definitely proscribed. This list of prohibitions included unlawful entry upon any property belonging to or controlled by the employers or upon lands adjacent to the mines, whether owned by parties to the dispute or not, and the collection of crowds, for the purpose of intimidation, upon or near any public road or railroad over which men were transported by the mine owners or their agents for the operation of their plants. To make the edict still more effective, all interference with the hiring of other workers was declared illegal. Banners and posters intended to insult or overawe strike-breakers with such cryptic remarks as "yellow dog" were placed under the judicial ban; these silent sentinels were not to be located on any highway or in any railroad station within a radius of ten miles from the mines. Having generally



forbidden the strikers to do anything likely to disturb the business of their former employers, the court nevertheless enumerated certain forms of picketing which were permissible.

For the reason that an injunction may make a strike illegal in all its fundamental aspects, labor leaders have sought to restrict the use of this weapon. In Arizona they secured the passage of a law prohibiting the issuance of an injunction preventing strikers from criticizing employers in strong language, patrolling in front of their places of employment carrying banners, or otherwise disturbing business. But the Supreme Court of the United States declared the Arizona act in conflict with the Federal Constitution, thereby putting an end to such local efforts to limit the use of the writ effectively.

Workers have also turned to Congress for relief. When the Democrats came into office in 1913, they listened sympathetically to the demands of labor and passed a statute intended to place restraints on injunctions. The measure specified that bills of injunction should not prohibit persons singly or in concert from ceasing to work, or from persuading others in a peaceful manner to quit, or from boycotting a party to the dispute, or from peacefully assembling. However, in interpreting the statute, the courts narrowed the scope of the new provisions, blasting the expectations of organized labor. In fact during 1922 a Federal district court in Chicago issued an injunction against railway shopmen more sweeping in its terms than most decrees on record previous to the enactment of the new law. This broad writ forbade them to picket or to encourage any person to leave his employment or refrain from entering employment, by "letters," printed or other circulars, telegrams, telephone, word of mouth, oral persuasion, suggestion, or in any manner whatsoever.

This and other judicial decisions authorizing drastic use of the injunction in labor disputes led to a renewed agitation in

Congress for positive limitations on the actions of the courts. The result was the enactment of the Norris-LaGuardia Act, signed by the President on March 23, 1932, placing more explicit restraints on the jurisdiction of the Federal courts in this respect. Whether these new restraints will be whittled away by judicial interpretation remains for the future to determine. Moreover, the whole business is complicated by the labor relations established under the industrial codes drawn up in accordance with the terms of the National Industrial Recovery Act of 1933 (Chapter XVIII). Beyond question here is a problem in management of vital concern to engineers and to technological industries in general.

Although the injunction attracts the public attention on account of its relation to labor disputes, its true importance is less spectacular. It is one of the most efficient quick-action instruments of government, for it can be brought swiftly into use on a mere application to a judge authorized to issue the writ if he so decides. It may be employed to restrain a public authority from putting into effect a law or decree, or a private party from performing an act deemed injurious to the rights of the applicant. While it does not determine the merits of the controversy raised, it holds things in course or in their present state—as the case may be—until the whole question can be resolved by orderly procedure. It may, to be sure, become an instrument of delay but delay may be necessary to secure an enforcement of law and a realization of rights in the manner required by law.

**Actions against Government Officers.** As noted above, public officers as well as private parties may violate law. If a public officer fails to discharge a duty imposed upon him by law, he may be compelled, except in matters too special to be considered here, to fulfill his obligations by an order known as a *mandamus* issued by a court of proper jurisdiction.

To illustrate: a certain party staked out a claim on the public lands, acquiring temporary rights over valuable oil

shale deposits. Under national statutes, each claimant must perform \$100 worth of labor every year for five years in order to secure permanent possession of the land. If he fails to do this, another person may restake the same claim for himself just as if it were virgin soil. In case, however, no new claimant appears the original holder keeps the property for the moment. Now the party in question systematically put in the requisite amount of labor each year, except one, and fortunately for him no one took advantage of the lapse. Finally the occupant asked for a "patent" on the tract under a provision of law that when a total of \$500 has been spent on improvements the area can be permanently transferred from government hands to the applicant. But the Secretary of the Interior, in charge of the Department making out such patents, refused to turn over the deed, on the ground that a single omission had invalidated the owner's claim. Believing that the ruling was contrary to law, the aggrieved party went into court and asked for a writ of *mandamus* directing the Secretary to prepare the desired patent. After the Supreme Court of the United States had reviewed the case, it agreed with the plaintiff that the failure to perform statutory duties for a single year had not destroyed the claim. So a writ of *mandamus* was made out, ordering the Secretary of the Interior to grant final papers to the claimant. The writ of *mandamus* is one of the few tools which the average citizen can use to force political agents to mete out treatment prescribed by law.

**Types of Law—Written and Common Law.** Cases of dispute between parties in a court may involve different types of law. First come the formal measures enacted by constitutional conventions, popular vote, legislative bodies, and administrative agencies—items enacted to carry out organized will. This type is called written law. Next is the common law, consisting of customs which, because they once won popular approval, are recognized by the courts as proper guides in individual relations that are not covered



by the written law. Thus if a man and a woman live together to all outward appearances as though united in matrimony, they are in due time considered to be married under the common law where the latter has not been altered by statute. Naturally as centuries have passed since the courts in England first began to adopt current habits as binding, a great mass of common-law decisions has been accumulated. It is customary to give much weight to precedent so that if a case is decided in a certain fashion, under the common law, subsequent verdicts are very likely to follow along the same line of reasoning. The common law is employed practically everywhere through the nation as a supplement to written law.

**Equity.** Distinct from written and common law is a peculiar kind of law known as equity. In England, whence came this conception, it was early discovered that the ordinary law often worked injustice, and the practice grew up of appealing to the Crown for relief in such cases. In time the King's chancellor was assigned the duty of hearing petitions for relief from injustice done in the regular courts acting in accordance with the strict terms of the law. In due course decisions in these cases built up a body of law called equity. When the United States became independent the business of hearing equity cases was assigned as a rule to the regular courts sitting as courts of equity. Hence a citizen who cannot obtain relief by the ordinary judicial process may raise a case in equity and receive special consideration. For example, if the purchaser of a piece of land finds that the boundaries are wrongfully described in his deed, he may institute equity proceedings to compel the rectification of the error.

**Civil and Criminal Law.** Running through the law is the distinction between civil affairs and crimes. Civil affairs include the rights of persons against other parties, involving personal and property rights, to be defined by the courts under law. If a manufacturing concern makes a contract

with a party to deliver a piece of machinery on a given date and fails to make delivery, the latter may bring an action for damages against the former. This would be a civil action. Criminal law, on the other hand, has to do with offenses against the public. A violation of the motor vehicle law of a state is an offense against that state, is a crime. Some offenses, however, are both civil and criminal. Reckless driving on a highway resulting in damage to another vehicle is an offense against the state, subject to penalty, and also a wrong to the owner of the damaged vehicle, for which the negligent driver may be ordered to pay appropriate compensation. Criminal and civil cases are tried separately, not in one procedure.

**Technological Branches of Law.** In all departments of law technological operations and questions are increasingly prominent—in criminal as well as civil law; and only experts in technology can deal with them realistically. In most crimes, from failures to observe sanitary ordinances to murders, technical instrumentalities are involved. Did the particular action produce results that were unsanitary within the meaning of the law? Did the death result from the administering of poisonous chemicals? Literally thousands of issues that are highly technical in nature are raised in courts every week. And the practice of law tends to specialize along technological lines. There are lawyers who concentrate their entire energies on patent, aviation, marine, railway, radio, or other technical branches of law. For some of these divisions technical journals are published to keep lawyers, engineers, and other interested persons currently informed.

In time, it is highly probable, this development of technical law will work radical changes in the ideas and methods of lawyers. Up to the present, lawyers and judges have generally approached technological questions from the standpoint of historic law—the law applied in older days running far back into English history. When they face a technological

question, they do not seek a complete answer in the rationality of technology, but to "interpret" some old principle appropriate to hand industry in such a way as to do "justice." In the process, however, they learn something about technology and work its mandates into their "reasoning." As technological questions in law multiply, the tables may be reversed. Technologists may approach the law from their angle, and the rationality of their science may become dominant. At all events, an interpenetration of law and technology is already here and this development is likely to increase rapidly.

#### COURT ORGANIZATION AND PROCEDURE

**Jurisdiction of Federal Courts.** The classes of cases described above are tried in a wide variety of courts. It is so easy to become confused by this maze of agencies that a brief outline of their organization and powers is necessary to an understanding of law enforcement. Two separate and distinct court systems are in operation—Federal and state.

Examining the former, we find that it possesses jurisdiction or power over a wide range of matters. Inevitably problems involving national treaties, laws, or the Constitution come within its field of work. Thus if an alien claims certain privileges under an agreement existing between his country and the United States, he may take the issue to a Federal court. Similarly, should a controversy arise under national patent laws, or should a citizen feel that he has been deprived of property without due process of law, in violation of the Constitution, he may ultimately ask for relief in the same system of courts.

The nature of the contestants, as well as that of the issues at stake, is also a controlling factor. Suits affecting ambassadors, other public ministers, and consuls may come before the Federal courts. Any action to which the United States is a party, either as plaintiff or where it allows itself to be sued, may come up in the Federal courts. Finally certain





*Photograph by Acme Newspictures, Inc.*

### THE RADIO EQUIPMENT OF A BAND OF CRIMINALS

Mr. W. J. Calhoun, Federal agent, surrounded by short-wave radio apparatus seized from a powerful band of criminals. The unlicensed transmitter was employed in communicating with smuggling vessels.



*Photograph copyrighted by the Chicago Aerial Survey Co.*

### A MAJOR PROJECT BUILT UNDER COURT ORDER

The North Side Sewage Treatment Works of the Sanitary District of Chicago, built for approximately \$20,000,000 to handle a maximum flow of 175,000,000 gallons per day. This is one of several plants constructed in compliance with an order of the Supreme Court of the United States (*see p. 36*).

cases in which a state or citizens of different states are parties may be taken into the Federal courts. Belonging to this category would be a dispute between two states over water diversion (p. 36). Where a state institutes proceedings against a citizen of another state the Federal courts hear the matter, for obviously a state could not enforce its court order in the home territory of its opponent.

**Federal District Courts.** For the settlement of controversies coming within the scope of national judicial power, an ascending series of Federal tribunals is provided. At the bottom of the scale is to be found a large number of District Courts, having jurisdiction over Federal cases arising within their special districts. Every state contains at least one such area, while many embrace two or more districts. A large number of Federal issues are brought up for initial trial in these courts, and many matters go no farther. On the other hand a disputant who is dissatisfied with a judgment is entitled by law to appeal to a higher Federal court for reconsideration of the controversy.

**Federal Circuit Courts.** Directly above the District Courts in rank are the Circuit Courts, each having control over affairs within one of the ten great circuits into which the United States is divided. The name "circuit" is derived from the former practice of the judges in moving about over their respective court areas, holding sessions first in one city and then in another, to relieve parties from the expense of making long trips to some central headquarters. Circuit Courts have only appellate jurisdiction. That is, they can review cases brought up from lower courts but cannot hear disputes which have not already been heard below. Many matters are finally determined by these tribunals. In other instances the law allows a further appeal to the court of last resort.

**United States Supreme Court.** At the head of the Federal system is the Supreme Court of the United States, sitting in Washington, D. C. It is a tribunal of last resort, for after it



has rendered a decision on a given issue, there is no further review. Cases come to it from several sources. Certain disputes, such as those between two states, may be tried for the first time in its chambers. In other cases its jurisdiction is appellate. Many issues are carried to the Supreme Court from District and Circuit Courts. Then, too, when a Federal question is involved, the Supreme Court will also review controversies brought up from the highest state courts having jurisdiction over such controversies (p. 181). It is not always necessary to wait on the final decision of a lower court before appealing. Through a "writ of certiorari" the Supreme Court can direct that a specific matter be brought before it at once. Where interesting points of fundamental law are involved, this writ is often employed. Since minor problems are sifted out in the lower tribunals, and questions of national importance form the bulk of its business, the Supreme Court is the outstanding judicial body of the land.

**Minor State and Local Courts.** Just as Federal courts have jurisdiction over specific matters of national concern, so state courts hear cases of state and local significance. Each state has its own system. As there is a great deal of variation between the organization and authority of the judicial units in different states, we can only outline the general features of the structure. At the bottom of the ladder are the so-called minor courts. In the latter classification are the courts of the justices of the peace in rural regions and police courts and petty civil courts in cities, whose judges are often not especially learned in the law, and who handle matters in an informal way suited to the small value of the property at stake or the trivial nature of the crime alleged. Typical of the disputants coming before them would be a landlord suing for a month's unpaid rent, a woman demanding damages from a dry cleaner for ruining her dress, a man asking for the value of his lawn-mower which a neighbor had borrowed but failed to return, or an assault and battery victim suffering from only a bloody nose.

One rung above the minor judiciary are local courts of counties or districts which hear minor civil and criminal cases on appeal from below or more important matters originally. Often there are several types of such bodies within a single state. There may be a special probate court, charged with handling estates, probating wills, and generally administering the affairs of deceased persons. There may be separate courts of equity (p. 176). Thirdly, there may be distinct criminal courts, bearing such names as Court of Quarter Sessions of the Peace, Court of Oyer and Terminer, and General Jail Delivery. Where this separation of business occurs, civil cases come before civil courts.

**State Courts of Appeal.** To relieve the highest or supreme court of a state of the necessity of reviewing all appeals from local courts, an intermediate court of appeals is commonly provided. The names vary, Georgia calling it a Court of Appeals; Indiana, the Appellate Court. Sometimes the pressure of business is such that the Federal practice is followed, and several courts of appeal are set up, each having charge of matters in a given district. Ohio has such courts, and so has California. Appeal courts frequently have no original jurisdiction, but merely review cases. Often their decision on review is final. In other instances, appeals may be taken to the highest or supreme court of the state.

**State Supreme Courts.** At the head of the state system is a single tribunal. Every state has such a body, generally known as the Supreme Court. This is the court of last resort in the state; its decisions are final except in matters that may be carried into the Federal courts. Most of its business comes to it from lower courts—business involving property above a given value or special points of civil and criminal law. Occasionally the state supreme courts hear cases that have not passed through lower courts, but the practice is rare.

**Specialization in Courts.** So far we have been dealing with courts as they have developed through the centuries for

the transaction of judicial business. This business, however, has been immensely complicated by the development of technology in its far-reaching effects on industry, transportation, and urban and rural life. At innumerable points, especially in connection with health, safety, and business practices, highly technical questions, involving chemical, electrical, and mechanical engineering in particular, arise under criminal laws forbidding actions, the use of devices, and procedures deemed injurious to the state, that is, the public. Under this head comes factory and mine regulation, for example. In the field of civil law, which is concerned with all kinds of private property and property rights, equally complicated issues also appear for judicial settlement. Indeed judging by the enormous volume of civil and criminal cases involving physics and chemistry, the courts are expected to be proficient in natural science as well as in the law itself.

Slowly, too slowly, this fact has been recognized by legislators, and several special tribunals have been established to hear particular classes of cases of a technical character. For example, under Federal auspices, there is the Court of Customs and Patent Appeals. The creation of this tribunal was the outcome of long and insistent efforts to remove patent disputes from the regular courts, which were often found to be seriously lacking in the technical training necessary for the competent handling of such issues of law and fact. Being equipped by experience in such litigation for the examination of intricate machinery, the manipulation of models, and the examination of complex evidence involving mathematics, physics, chemistry, and other sciences, the judges of the Court of Customs and Patent Appeals are able to bring technical knowledge to bear in patent cases. In many cities, likewise, specialization is to be observed in courts for the trial of cases arising under traffic laws. It is highly probable that, in time, further legal specialization will be carried out along lines indicated by technological specialization.



**Complexity of Our Court System.** Even from this summary description of the judicial system it is apparent that complexity is a prominent feature. Courts have been created one after the other as needs have arisen, sometimes without sharply delimiting the new jurisdictions from the old functions. Since the nature of the case, the amount of property at stake, the gravity of the crime in question, or the points of law involved are often uncertain, legitimate differences of opinion may arise as to the proper court in which to start proceedings and as to the lines of appeal to be taken from decisions in the lower tribunals. Frequently the jurisdictions of courts overlap so that a particular case may be brought up in one of two or more courts. It may happen that a cause may be carried before one or more state courts or one or more Federal courts. Thus lawyers may choose. If, however, they make a mistake, their business may be thrown out of court and they may be compelled to institute proceedings in another tribunal. Further, it is not always easy to discover when appeal may be taken from lower courts, and rights may be lost by failure to carry issues higher in the scale of tribunals.

**Judges.** Outwardly, procedure in the court room is relatively simple and is so frequently dramatized on the stage or in the movies that the ordinary citizen is more or less familiar with it. Proceedings are directed by the judge or, in a court composed of two or more judges, by the presiding judge. Sitting on a raised platform, the judge in charge is in a favorable position for watching everything that goes on in the room. He maintains order and decorum, seeks to eliminate improper evidence, hears the arguments of counsel, makes rulings, and at the end instructs the jury or formulates the decision, alone or with the help of his colleagues on the bench, if a jury is not employed.

Obviously great powers and responsibilities are imposed on judges, especially in the higher courts. In a large measure they determine the meaning of the law by their interpreta-

tion. They decide what facts, technological or otherwise, may be brought in or ruled out as evidence, and in technological cases everything may turn on the facts admitted in evidence.

Since this is true, it would appear that the greatest care should be exercised in the selection of judges; but this is by no means always done. Some judges are elected by popular vote in the dust and heat of political campaigns, for terms long or short, as the law may provide. Other judges, in some states and throughout the Federal system, are appointed by executive authority, with the approval of the upper house of the legislature. Whatever the practice, partisan, political, or other considerations besides sheer competence will enter into the selection of the average American judge. Neither popular election nor executive selection is a guarantee that competence will be assured for handling involved technological cases.

**Juries.** Another element in court-room procedure is the jury, which is employed in an enormous number of cases, civil and criminal. It is a panel of twelve persons, as a rule. They are frequently chosen at the start by taking names at random from the tax lists and placing them on cards that are dropped into a box. After shaking, the name cards of the prospective jurors are drawn by lot. The persons chosen must put aside other activities during the trial, and since their compensation is slight they are often compelled to make a sacrifice for the public good. For this reason there is a widespread aversion to jury duty, especially among citizens likely to be competent to handle any complicated business. When the jury is chosen a foreman is selected to serve as the mouthpiece of the group. As already indicated, the use of the jury is not required in all cases. In some, particularly those involving high crimes, jury trial is mandatory. From others, it is ruled out by law. In still other instances, the parties to the litigation may choose or waive jury trial. Where the option is permitted, lawyers and their

clients must exercise their wits in discovering whether trial by a judge or judges alone or by twelve persons selected in a haphazard manner is preferable.

**Witnesses.** Witnesses form an additional feature in court procedure. Briefly, they are persons more or less familiar with the issues at stake in the particular piece of litigation, who are prepared to testify on behalf of the one or the other party. Naturally the contestants themselves are usually glad to act in this capacity. But outsiders—men and women who must drop their work, serve without adequate compensation, if any, and make themselves the unwilling targets for rapid-fire and vexing questions—do not as a matter of course enter upon their task with relish. In fact, they are usually about as reluctant to serve as is the average jury member. But like the latter, they may be summoned and compelled to appear, whether they wish to testify or not. Through sheer obstinacy in divulging information, they sometimes escape. Where they are inclined to coöperate, after a fashion, they must be selected with skill. A frank, agreeable sort of person carries more weight with the courts than a noisy or crafty type. Accordingly, the selection of witnesses may largely determine the ultimate fate of the issue at stake, and for this reason competent lawyers and litigants will give much time and thought to choosing proper witnesses from the available list and to preparing them for the stand.

**Attorneys.** Then there are the attorneys, lawyers who plead cases before the court. Private parties engaged in litigation are not always required by law to be represented by attorneys. Minor disagreements coming before justices of the peace, for example, may be argued by the contestants without the help of counsel. But in all important cases, the necessity of having skilled legal advice is imperative. So vast is the field of law, so crowded is it with technicalities, that the layman is helpless in attempting to handle any complicated business. Not only is he ignorant of the law,



court rules, and judicial customs; he finds it difficult to extol his own merits to the judge and jury.

Choosing a lawyer, therefore, is a serious affair. To be sure, lawyers usually have to demonstrate a specified skill in order to obtain a license to practice, but that is a slight safeguard. Since valuable papers and perhaps real secrets must be entrusted to the care of the attorney, it is obvious that he should be a man of integrity. Furthermore in technical matters it is essential that he should be well versed in the law especially applicable to the business in hand—corporation, utility, aviation, admiralty, radio, or railroad law, as the case may be.

Just as private persons have their lawyers, so public bodies have their own attorneys to represent them before the courts. The United States is provided with a staff of experts, subordinate to the Attorney-General, who take charge of legal matters for the Government. Each state and county, too, employs such officials. Attached to various important boards or commissions are miscellaneous solicitors, counsel, and other legal aids. Inasmuch as violations of criminal law are considered to be offenses against government, the latter automatically becomes a party to the trial of the accused in such instances. Consequently governments have "prosecuting attorneys" whose task it is to convict law-breakers wherever possible.

**Sheriffs, Constables, and Marshals.** Each court is provided with a group of special agents whose labors are requisite for the smooth working of judicial machinery. Upon the shoulders of the clerk falls the task of keeping records of proceedings, issuing certified copies of them, and drawing up certain routine forms or writs. Sheriffs and marshals act as administrative officers. They enforce the law, seeing that arrested offenders do not escape before or during trial. They serve papers on witnesses and jurymen, ordering them to attend sessions of the court. After judgments are rendered, they execute the same. For example,

if it is necessary to auction the belongings of some unfortunate in order to satisfy a valid claim against him, the sheriff will manage the sale. Similar to the sheriff is the constable, who performs somewhat analogous duties at the request of minor courts, of which those run by the justices of the peace are typical. Also very old in origin is the post of coroner. This official examines cases of sudden death, often with the aid of a jury, in order to determine whether any suspicious circumstances surround the incidents, which call for further investigation. In the Federal courts, United States marshals discharge the functions of sheriffs and constables. The marshal serves summons, takes charge of prisoners, and executes judgments.

**Summons.** Court proceedings follow a rigorous routine. At the outset the parties involved have to prepare preliminary statements of their claims and answers so that the judge can decide whether the aggrieved party has a strong enough case to justify further action. When it is agreed that valid legal points have been raised for trial, the court process is set in motion. The initial step is to secure the attendance of the necessary witnesses and jurymen, if any. If they will not attend of their own volition, a "subpoena" is issued, in the form of an order commanding the recalcitrants to come before the court. Failure to obey the summons renders the offenders liable to fine or imprisonment for contempt of court. In practice, the summons is effective only within the limited radius of the tribunal involved. As far as jurors are concerned, this does not matter for they are invariably local residents. But witnesses, who may be located in other states or nations, present a different problem. If the latter are living at a great distance and cannot attend, it is customary to secure duly sworn statements from them in the form of depositions which may be read in court.

**Court Routine.** On the appointed day the disputants, with their lawyers and witnesses, file in. If the pressure of business is such that the case cannot be reached in proper

order, it is postponed to a subsequent date. When everything is at last on schedule, the court is formally opened. A jury, if employed in the case, is promptly selected. Usually a panel of some thirty persons is present. From these a dozen members are chosen by lot. Persons so chosen may be challenged by the lawyers. Thus the attorney for a laborer, in an industrial accident damage suit, may ask the judge to exclude certain manufacturers from the jury, while the attorney for the company may seek to eliminate workmen from that body. Such testing of jurors is designed to eliminate individuals who bring inherent prejudices to bear on the issues at stake, thereby preventing an unbiased opinion. If the judge agrees that a particular individual is unfit, another is selected to take his post. The challenging terminated and the jurors duly sworn, introductory speeches may be made by either or both sides, outlining the arguments to be presented. With these preliminaries over, the court begins the trial.

As a next move, the lawyer for the plaintiff calls his witnesses to the stand, in succession. Each in turn formally swears to tell the truth; violations of the pledge carry punishment for perjury. Following the oath, the attorney for the plaintiff asks the witness questions which he must promptly answer. In the process, two types of interrogation are considered improper. "Leading questions," in which attorneys suggest facts to a witness rather than forcing him to supply them of his own accord, are forbidden. Thus the inquiry, "Did you see John Doe on Sunday afternoon, July 10th, 1932, at 3 o'clock, walking into Richard Roe's drug store?" would be improper. The correct method would be to ask the witness when and where he saw John Doe. A second type of prohibited query is one that is irrelevant or immaterial. Not only would the latter waste the time of the court but it might incidentally prejudice the jury in the bargain. If an attorney is suspected of committing either offense, the opposing lawyer is free to rise and object immediately,



pleading with the judge to force the withdrawal of the question, or, if it has been replied to, to have him cross the response off the record. During an ordinary trial, objections are frequent, and improper rulings by the court form the basis of appeal.

After the direct examination of a witness by the attorney for the party on whose behalf he appears is at an end, the opposition has its opportunity. The lawyer for the latter has the right to cross-examine the witness, that is, to ask him questions with a view to tearing down his previous testimony. Where the witness is rather weak in memory, or is blunderingly trying to cover up facts, the cross-examiner seeks to lead him on until he unexpectedly slips up in the excitement, and is discredited. On the other hand if the attack is too severe, the poor target may win the sympathy of the jury, and the lawyer may defeat his own ends. Besides the attorneys, the judge may also cross-examine whenever he pleases. Occasionally he exercises his privilege so extensively as to take the case almost out of the contestants' hands. Usually, though, he sits back and lets the two parties fight things out unaided, save when moved to intervene as a kind of umpire at the game. Finally the jury possesses the power of interrogation. Not being skilled in procedure, the jurors are apt to ask improper questions; but attorneys are loathe to object for fear of offending the very men who must ultimately decide the issue. After the cross-examination is over, the attorney who originally called the witness is entitled to make further inquiries to clear up new points just brought out. A second cross-examination may theoretically follow, but the privilege is rarely exercised.

After testimony is heard, if one side or the other is clearly entitled to a verdict, the judge may instruct the jury to make the award as ordered. If there are valid grounds for dispute, then the jury is given latitude in making its decision. In the latter case, each attorney is allowed to sum up his case before the jury. This over, the judge gives a further

summary of his own, in which he passes upon the leading points, asking the jury merely to settle other questions of law and fact according to their honest convictions. After receiving their directions, the members of the jury retire to consider the issues at stake. Generally unanimity of opinion is necessary to a decision. If it is utterly impossible for the jurors to agree, they may be released. But if the judge thinks that they could by greater effort come to an agreement, they may be locked up in a room indefinitely. While in this plight they tend to compromise. After an agreement has been reached, they send word to the judge and are conducted back into court. There the foreman announces the decision of the jury and the trial is at an end.

Since many trials are conducted without a jury, mention should be made of this alternative process. On the whole, the procedure resembles that in jury trials, except that the judge does not require as many safeguards as jurors do; that is, there is less need for debates over objections to admission of evidence, for the judge is trained to know which portions to disregard. Similarly summations of the case by opposing lawyers may be eliminated without injury. Finally the judge renders his opinion, either at once or after some deliberation in his chambers.

**New Trials.** Even after all this preliminary work, the case may not yet be settled. Either side may ask for a new trial on various grounds, such as that the judge erred in admitting certain evidence or that the jury rendered a verdict in direct contradiction to the evidence. Usually the judge does not believe that he has erred and motions for new trials are likely to fail; nevertheless there is no harm in making the attempt. Sometimes it succeeds. If a new trial is denied, then recourse may be had to appeals.

**Appeals.** Appeals are common where the issues at stake are sufficient to warrant taking this step. Grounds vary; errors in admitting evidence or judicial rulings contrary to law are usually employed. Where an appeal is made, law-

yers for the two sides prepare briefs, stating their cases. Since no new evidence is allowed, there is no need for calling in witnesses. Attorneys for the respective parties merely present to the appellate court arguments in line with their briefs. Ordinarily each side is allotted a fixed amount of time in which to make its argument. As soon as the attorneys are through, the judges retire to consider the issues thus laid before them. In important matters their decision is not usually announced for some time, perhaps months, after the termination of the arguments.

Appellate courts generally consist of several judges. Some means of obtaining a consensus of opinion among them is thus imperative. In the United States Supreme Court, with nine judges, decisions are rendered by a majority vote. Each member examines the case, an informal vote is taken and one of the majority writes an opinion. As a majority of the members concur in this document, it becomes the final command and opinion of the court. Frequently there are dissenters, not enough to reverse the outcome, but enough to attract considerable attention. These dissenters may write opinions. Sometimes they all agree on a common conclusion, that is, concur in it. At other times each dissenter has his own reasons for opposing the majority and writes a dissenting opinion of his own. On important matters, these dissenting opinions generally make interesting reading. More than that, if the policies of the court should ever change, such opposing views may become dominant views.

The decision of the appellate court may affirm or deny a decision of the lower tribunal. In case of a reversal, the court of appeals may either render judgment for the plaintiff on appeal or, where the conditions warrant, order a new trial in the lower court. If, for example, it is found that the judge below erred in admitting or excluding evidence or committed other errors, he is in effect commanded to mend his ways in the new trial that must begin.

Where important principles or large amounts of property



are involved, appeals may be taken repeatedly until the highest tribunal is reached. Certain advantages inhere in the process. A single body thus passes upon many major issues, setting up guiding rules for a multitude of subordinate units. If this policy were not adopted, the latter could issue such a maze of conflicting opinions of their own that the law in one locality would be unreasonably dissimilar from that in another. Inklings of what might really happen within each state may be gained from numerous decisions in which the courts of different states actually interpret the same measure in various ways. The Commissioners on Uniform State Laws (p. 41) have found this tendency to be one of the greatest stumbling blocks in the way of their efforts to secure the benefits of standard practices to citizens throughout the Union. Unfortunately, while the system of appeal does serve to coördinate decisions, it is not an unmixed blessing. Clearly a man of limited means, even though he may have enough money to win his case in a lower court, may lose in the end because he is financially unable to take the last permissible appeal. Besides, the delay involved in going over the same ground three or more times in succession is burdensome. In any case, lawyers profit from the increased litigation and are likely to encourage such procedures.

An unusual illustration of prolonged litigation is found in connection with the injury of a brakeman on a New York railroad in 1882. He brought suit against the company, and in 1884 recovered \$4,000 damages. This judgment was reversed on appeal two years later. After a new trial he secured a second verdict, for \$4,900. Appeals were then taken to two courts in succession. The first affirmed and the second reversed the judgment. Undaunted, he brought a third action in 1889, in which the company won. Two appeals by the brakeman followed. On the first, the intermediate appellate court, in 1894, decided against him. On the second, three years afterwards, the court of last resort decided for

him. Now it was the turn of the railroad to try again. So for the fourth time the issue came up in the trial court, and a verdict for \$4,500 was recovered. Naturally the company appealed, and its efforts were crowned with success. Determined to get his money, the brakeman started a fifth action, obtaining a verdict for \$4,900. Once more the award was set aside on appeal. Still insistent, the plaintiff instituted a sixth proceeding, with exactly the same results. Finally, in 1902, twenty years after the first trial, a seventh and last hearing took place. The verdict this time was for \$4,500. Although the company appealed, it was defeated. Thus it took the workman two decades to secure compensation for injuries through regular judicial channels. One cannot help wondering how much the lawyers' fees amounted to on both sides. Such proceedings tend to make "justice" a farce.

### SPECIAL JUDICIAL BODIES

**Administrative Tribunals.** Besides the courts, regular or special as the case may be, there are several administrative tribunals. These bodies, while a part of the executive branch of the government, discharge judicial functions. Although constitutional mandates relative to the separation of powers (p. 96) apparently frown on the practice, it continues unabated. Our Federal boards of steamboat inspectors are typical of this general class. Each has the power to hear cases involving the misconduct of licensed marine officers in its particular locality. The mimicry of the courts is pronounced, even in the matter of appeals. Thus the decisions of a board can be carried to the supervising inspector of the district, who passes anew upon the issues at stake. When a party is dissatisfied with the action of the supervising inspector, a second review may be obtained from the supervising inspector-general, the head of the Federal Steamboat Inspection Service, whose decision (when duly approved by the Federal Secretary of Commerce) ends the case, unless

there is an appeal to the proper Federal court for the purpose of discovering whether he acted within the authority conferred upon him by law. Likewise, the Department of Commerce, through its Aëronautics Branch, has set up several bodies for dealing with violations of aviation law. Local counterparts of such national agencies are to be found in city zoning boards of appeal, charged with settling disputes over the interpretation of municipal building restrictions.

**Commercial Arbitration Boards.** With the rapid development of complicated technical and economic issues, efforts are being made to escape from the formal requirements of judicial proceedings which so often lead to almost endless delays. One of the novel methods employed is commercial arbitration. Where state law permits this practice, the procedure in general is as follows. Parties likely to be engaged in a controversy as a result of their dealings may sign in advance a document binding themselves to arbitrate all misunderstandings; and this contract may be enforced by appeal to the regular courts if one of the parties refuses to abide by his agreement. When parties so bound have a controversy, they draw up a "submission" in which they state their respective cases. Each names one member of the board of reference, which is to hear the controversy, and the two so chosen select the third.

After organizing, the board of reference informs the disputants of the time and place at which hearings will be conducted on the issues involved. Witnesses are subpoenaed and the production of books and records may be demanded, just as in court trials. Facts are then informally presented to the arbiters. After the case is duly presented, the referees retire to consider the testimony, and announce their award when they have completed their work. The loser dissatisfied with the result may next attack the decision in a regular court on the grounds that the referees were unduly biased or failed to do justice. If grave mistakes are demonstrated, the



court may intervene on appeal to amend the award. In the absence of such proof, it refrains from intervening. Whether revised or not, the award is entered as a judgment of the court, being thereafter enforceable as a judicial decree. Here the operation terminates.

Seven states—Illinois, Iowa, Maine, Michigan, Nebraska, Nevada, and New Hampshire—hold contracts made for the settlement of existing misunderstandings to be enforceable. New Jersey, Massachusetts, Pennsylvania, California, Oregon, and the Territory of Hawaii have not only adopted the same policy, but go a step farther and validate agreements covering any possible future controversies as well. Throughout the remainder of the country, however, parties may freely withdraw from arbitration proceedings at any time without becoming involved in any legal difficulties. Whatever its precise form, commercial arbitration permits the settlement of contests involving technological as well as pecuniary matters by a simple and direct procedure dealing with the merits of the dispute, conducted by expert laymen before special tribunals composed in each case of competent referees chosen for the purpose.

### CRIMINAL LAW ENFORCEMENT

**Technology in the Underworld.** Just as technology has brought about sweeping changes in industry, so it has revolutionized the underworld of crime. Scientific progress has afforded criminals a multitude of ingenious devices for the commission of both old and new offenses against society. Smugglers, for example, have discovered more elusive methods of plying their trade. Through the use of aircraft, persons and goods may be carried across the borders of the United States, far out of reach of patrolmen stationed on the ground. Such machines cannot be searched while in flight, and, by following a lonely course, they can frequently escape detection altogether. That the practice may prove profitable is evidenced by the claim that a convict, released

from prison almost penniless, amassed a fortune of five million dollars in five years through the use of aircraft in smuggling operations. Nor have the engineering staffs of smuggling bands been content with exploits in the sky. Taking a hint from naval history, one fitted out a small fleet of submarines for the more convenient transfer of liquor from Canada to the United States, *via* Lake Champlain. The apparatus consisted of tow boats, attached by sunken cables to motorless submersibles. Casual inspection of the launches revealed nothing suspicious, not even the wire connections. But when one of the underwater craft unexpectedly broke loose, and the owners began a search for it, the secret performance was discovered by officers of the law.

Robbers, like smugglers, are "progressive" when it comes to utilizing the latest inventions. Owning autos equipped with bulletproof glass, as well as armor plate, and wearing metal vests, robbers and burglars travel about ready for heavy fire. Weapons of many kinds are employed, as the amazing assembly of machine guns, bombs, and automatic small arms found in spectacular police raids repeatedly proves. Sometimes purchases of armaments are ostensibly made in behalf of a police department; at other times the absence of restrictions on the sale of firearms renders subterfuge unnecessary. To rifles and motors are added kits of mechanical "tools."

All technical preparations being completed for a "job," the gang moves to the scene of action. Arriving at a bank, the operators use nitroglycerine technique, nimble fingered knob-turning, or modern oxy-acetylene torches, as circumstances dictate. With the coveted treasure in their grasp, they rush to waiting machines and make a dash for safety. If necessary the retreat is well covered up through the copious discharge of fumes from apparatus patterned after military smoke-screen devices.

If the regular methods of operation become monotonous or outmoded, experiments can be evolved. Dynamite was

laid under a city street by a gang disguised as municipal employees. The explosive was connected by wires to controls hidden in a nearby room. In due course the expected armored truck bearing a large treasure rolled down the avenue; contact was made; and the vehicle was blown to bits; and before stunned spectators could get on their feet the scattered cash boxes had disappeared. Of such strange events is twentieth-century law-breaking composed; to the police, the unexpected is likely to happen.

**Federal Police.** To combat crime, old and new, the various units of American government possess extensive police forces—Federal agents alone totaling about 20,000 men. For tracking down law-breakers of all kinds, the Bureau of Investigation in the Department of Justice keeps a staff of detectives on the move. The remaining national forces have no general powers, but are confined to limited fields of work. A large squad of patrolmen employed by the Department of Labor devote themselves solely to the apprehension of smuggled aliens. The Customs Service and the Coast Guard, both parts of the Treasury Department, seek to halt the inflow of goods and materials in violation of the laws. Liquor control, naturally, is a prominent feature of their work. Through the Secret Service organization, the Treasury Department watches for counterfeiters of money or United States securities. Again, the Post Office Department is ever on guard against mail robbers and activities of those who use the mails for fraudulent purposes. Such specialization has its advantages, for detectives are thereby enabled to acquire a high degree of expertness in narrow lines of endeavor. But not all is gain; for if a Secret Service agent discovers the den of a supposed counterfeiter only to find that the man is a thief engaged in stealing insured letters, he must abandon the case and refer it to appropriate postal detectives. Valuable time may be lost meanwhile.

**Local Police.** Distinct from national agents are the officers employed by various localities, whether towns, counties, or



cities. In rural regions sheriffs and constables regularly take charge, performing the duties described above (p. 186). Cities possess more modern types of enforcement agencies, keeping veritable armies of trained and uniformed men constantly on guard. New York has 14,000 police, Chicago some 6,000, and other metropolitan centers correspondingly large bodies. Naturally a given governmental unit cannot empower its law officers to operate outside its own boundaries. Consequently it is often well-nigh impossible for them to deal with criminals employing modern high-speed motor equipment.

**State Police.** A few states—Connecticut, Massachusetts, Michigan, New Jersey, New York, Pennsylvania, Texas, and West Virginia—have supplemented their local agencies by state police. Such a force may vary from less than a hundred men to several hundred, depending upon needs and the willingness of state legislatures to appropriate money. In addition to state units engaged in general law enforcement, special squads are sometimes organized to apprehend special classes of offenders—against motor vehicle laws, for instance. For the establishment of state forces two principal reasons are assigned. First, local agents limited to small districts cannot cope effectively with modern criminals equipped with their own means of rapid transit; only a state-wide force can perform this service. Secondly, the governor needs a force which he can employ quickly when political subdivisions neglect their duties in law enforcement. For example, when the City of Hamtramck, Michigan, surrounded by the City of Detroit, was once alleged to be “running wide open,” outside intervention was invoked; and the governor dispatched his force in a series of raids for the purpose of bringing the recalcitrant community into line with the public policies prevailing elsewhere in the state.

**Use of Troops.** When severe disturbances arise that cannot be effectively handled through regular police channels,

troops may be called upon to restore order. Each governor, as commander-in-chief of his state militia (p. 338), possesses the power to mobilize it on a moment's notice. If his militia-men prove incapable of coping with the situation themselves, he may request the President of the United States to send reënforcements from the regular Army—with the consent of the state legislature, if it is in session.

Although the framers of our constitutions expected that such military agencies would be employed primarily to stamp out open rebellion, the development of technology has changed the emphasis. Today soldiers are used in domestic disturbances, not to overcome revolutionists but mainly to deal with strikes and otherwise participate in allaying industrial unrest. Martial law is a frequent adjunct to operations of this character. The governor of a state or the President of the United States<sup>1</sup> may establish a rule of iron by merely issuing a proclamation declaring that public welfare and safety require a suspension of ordinary civil government and the establishment of martial law. As commander of the military forces, the chief executive is then free to do about as he pleases. Drastic indeed is this step, but it has been taken on many occasions. Oklahoma, for example, once resorted to military methods in shutting down oil wells that threatened to keep prices low through continued overproduction.

**Private Police Commissioned by the Government.** Men employed by private companies to provide special protection for their properties are sometimes commissioned as government officers. In Pennsylvania, industrial unrest in the coal and iron districts has led some of the large corporations to hire small "armies" of this sort, known as the Coal and Iron Police. Not being under the control of a responsible state executive, they may be a law unto themselves. During bitter labor disputes, in recent years, these loosely organized bodies have become storm centers of controversy.

<sup>1</sup> Under authorization of Congress.

Workmen accuse them of reckless beating and shooting; capitalists claim that there is no other agency in the field capable of preventing wholesale destruction of property and the intimidation of operators.

**Technical Facilities of Modern Police.** Owing to the demands made upon modern police departments by developments in criminal technique, the duties of officers today are markedly different from those of their predecessors. For one thing, the ability of bandits to dash for safety beyond the border calls for enormously increased police mobility. High-speed motorcycles and automobiles must be used in the chase. For harbor work, powerful motorboats are supplied to government agents. Certain localities have even gone so far as to establish aviation units, New York City being in this class. It is recorded that a municipal plane picked up the trail of a man wanted in a murder affair and finally overtook him though he sought to outdistance his pursuers by traveling aboard a steamer. So the technical revolution of the twentieth century invades law enforcement as it does so many other fields of life.

More is required of the police than sheer capacity for travel at high rates of speed. On account of the long and quick runs made by modern bandits, the rapid flash of news from one locality to another can greatly assist in the chase by blocking avenues of escape. Already many cities have inaugurated radio control of police patrol cars. Under this arrangement, a central broadcasting station picks up telephone calls of all kinds and puts them on the air. Police automobiles and sometimes even motorcycles are equipped with receivers so that the latest information is instantaneously obtained by men on their rounds. As a result, men strategically located throughout the area are in constant touch with events at headquarters. As an additional means of communication, teletype nets have been placed in operation in many regions. Briefly, these nets consist of automatic typewriters linked together by electric connections. Mes-



sages typed on one keyboard are duplicated immediately in all offices within the network. Thus the police of one municipality or state can dash off notes for the guidance of similar agents in surrounding districts. A series of extraordinary captures has followed in the wake of the installation of such apparatus. Modern communication acts as a strong defense against the underworld.

Detection as well as pursuit has undergone a transformation at the hands of technology. Progressive units of government have installed scientific police laboratories, equipping them with the latest devices. Fingerprint files are kept, and arrangements are made for interchanges of records among offices. Ballistic experts, by the examination of guns and test bullets, are often able to identify specific weapons as those used in particular crimes. Casts of automobile tire tracks, when compared with the treads of commercial makes of tires, have also led to arrests. Microscopic studies of dust reveal interesting details; a burglar who had robbed a flour mill was led to confess when powerful lenses revealed the presence of tell-tale powder in the fabric of his coat. Even hair is sometimes given "personality" under high magnification. Blood examinations afford further clues. Photographic records of the scenes of crimes preserve for an indefinite time minute details that might otherwise escape notice. Fine measurements can be made from the resulting positives if necessary. Detective stories of today, although seemingly fantastic, are frequently true.

**Prisons.** Offenders, apprehended and convicted, are often sentenced to prison. All important units of government—Federal, state, or local—maintain institutions for the confinement of criminals. Here occupants are sometimes put to work at various trades, experience having taught that enforced idleness breeds dangerous unrest. An effort is now made to teach them useful arts in order that they may be better prepared honestly to earn a livelihood after their release. Automobile license plates, shoes, and furniture are

typical products of prison industries. Whether prisoners should be given arduous or light work forms a subject of constant controversy. One powerful faction maintains that severity and even the ruthless driving of men in chain gangs is "good medicine," acting as a strong deterrent to law-breaking. In opposition it is contended that the process results in nothing more than the brutalization of the victims. But whatever the form prison labor takes, organized trade unions fear the competition. There is indeed a large measure of justice in their claim that the law-abiding citizens should not be deprived of employment by cut-price convict wares displayed in the market place. So the subject of penology is torn by internal dissensions.

**Parole.** Carrying out the idea that the purpose of a sentence should be one of reform, a system of parole has been invented. Under this arrangement, model prisoners are released from jail before their full term is served. During the unexpired period they are as free as other citizens, except for a limited surveillance. Government officers are supposed to check up at periodic intervals on the conduct of prisoners on parole, to make certain that they are behaving properly. In case a man on parole is found to be abusing his privileges by resorting to crime, he is returned to his cell upon capture. Besides serving as a means of rehabilitating offenders who have made missteps, the procedure helps to relieve the crowded prisons.

**Corruption as an Obstacle to Enforcement.** Inevitably the whole problem of law enforcement, from pursuit to imprisonment, has come in for thorough-going investigation, especially with the growth of modern racketeering in many lines of crime and industry. Undoubtedly an important factor contributing to the present unsatisfactory state of affairs is the attitude of the public. Where citizens are prone to condone crime, viewing gangsters as enviable heroes who have managed to avoid the hum-drum routine of everyday life in an interesting manner, punishment is rendered diffi-

cult. Criminals step from hiding, boldly enter politics, buy protection from the police, "fix" juries, pass money to judges, and threaten the lives of witnesses. By hiring skilled attorneys, they take advantage of a multitude of technical loopholes in legal procedure to escape their just deserts. The trend is sufficiently apparent to any newspaper reader. Nothing short of nation-wide efforts can effectively check it.

**Extradition as an Obstacle to Enforcement.** Finally, the difficulties of extradition may operate in aid of criminals. Suppose that A commits a murder in Ohio, and immediately escapes into Indiana; his hideout is discovered, and he is finally arrested upon information from Ohio police authorities. Then the governor of Ohio transmits to the governor of Indiana a request for the surrender of the accused. What happens next? The Federal Constitution announces that it is the duty of the governor of one state to surrender captured offenders to the officers of the place where they would normally be brought to trial. But as interpreted by the Supreme Court the word "duty" implies only a moral obligation. If a governor refuses, for any reason, to give up the accused, there are no means for compelling action. A similar situation exists in the case of international movements among criminals, for the operation of the system depends on the good will and coöperative spirit of foreign governments acting under extradition treaties.

#### A TECHNOLOGICAL RECONSIDERATION OF JUDICIAL PROCESSES SUGGESTED

**Technical Aspects of Law and Enforcement.** When the immense body of law—constitutions, statutes, charters, ordinances, administrative decrees, common law, equity, and judicial and administrative decisions—is taken into account, it becomes evident that a large part of it pertains directly to technological operations. Much of it concerns only technical facts. The boilers of a steamship must conform to certain technical specifications, for example, and



when an issue of enforcement or liability for an accident arises, everything may turn squarely on actual compliance of the boilers with specifications. Those who have given little study to this phase of law will be surprised to find how much of it can be brought within the scope of strictly scientific determination. Again, mine-safety legislation is designed to protect human health and life and to this end certain technical requirements are established. Here law enforcement means compliance with these standards, and compliance is a matter of scientific precision, within fair limits. In actions for damages arising under such legislation, decisions will turn on the degree of compliance provided by the parties responsible. This degree of compliance is an issue of fact to be resolved by persons competent in mining engineering. And as we have already seen, into cases involving human sentiments and values, such as crimes of passion committed by the use of poisons or weapons or even by the use of the bare hands, scientific considerations may enter. Experts in chemicals or ballistics may be necessary to the development of exact evidence, or a physician may be called to determine whether the victim actually died of violence or an incidental failure of some vital organ, such as the heart.

**Property Rights and Technology.** In the field of private law concerned with property and property rights, the revolutionary effects of the technological transformation can be seen in even a superficial comparison of Blackstone's celebrated commentaries on the law of England, published in the eighteenth century, with any contemporary body of law. The law of property has a long history running back into antiquity for thousands of years, and the continuity has never been entirely broken. The traditions and training of lawyers and judges stem from the same sources. On the other hand the steam-driven factory is less than two hundred years old, and electrical mass-production is less than fifty years old. The traditional law of property is derived from days when property consisted of tangibles—houses, land,

cattle, and tools, or rights in the same. The nature of each piece of property was easily grasped by the lay mind, even when legal rights in such property were complicated. The uses to which such property was or could be put were also easily understood. Each piece of property, a wagon, for example, had a definite locus and range of operations in time and space. The commodities of consumption produced by the use of property were likewise simple. Their nature and uses could also be grasped by the lowest common denominator of the population. Any judge or juror chosen to try a case involving such property had little or no difficulty in understanding its character and possible uses.

Now contrast that simple situation in which property law arose with the highly complicated situation surrounding technological property and uses. Technology has created intangibles such as the radio current which cuts across boundaries of properties and nations and penetrates offices, homes, and shops. Modern electric current is unlike any kind of property known to Blackstone or the founders of the American Republic. Technology has created thousands of new objects of property, machines, devices, practices, and commodities. It has created substances composed of highly complicated chemicals. Its plants send out fumes, gases, and wastes which may impinge upon distant property and work damages unknown to old law. It has created new machines, such as the airplane which cannot be operated in a fixed locus and in operation affects property adjoining that from which it takes off or lands. By its very nature, the airplane as now contrived must take off at a given rate of climb, according to size and construction, and that climb may impose an operating servitude on lots near an airport. Technology has created thousands of patents, highly complicated, involving innumerable subtle claims and counter-claims. These bewildering machines, products, and chemical substances of technology, unlike tallow candles and stage-coaches, are not entities grasped by untrained minds and

common understanding. Their nature and uses are hidden from most lay minds. Moreover the efficient use of them brings inevitable conflicts with numerous historic rights of property; and where historic rights are sustained against invasion, the rationality of technology may be defeated and disregarded to the long-run injury of society—the limitation of wealth production.

**A Trial Classification of Law Cases.** From the technical standpoint a new classification of cases is suggested. In the first class may be placed cases that are purely technological; these are cases where the issue is one of compliance with exact engineering standards, such as specifications for marine boilers or building construction. In such cases the issue is simple: Did the responsible person at the bar of the court comply, or not comply, with the standard specifications required by law? This is a matter of strict scientific determination which only technology can handle. In the second class may be put cases involving claims to damages where wrong and right turn entirely on technical evidence bearing on compliance or non-compliance with requirements prescribed by law. This group of cases includes damage to property arising from fumes, gases, or electrolysis; here degrees and nature of damage turn on purely scientific evidence. A third class embraces a multitude of cases where old legal precedents furnish no absolutely exact guidance, where the theories and practices of tradition are opposed to the rationality and efficiency of technological uses; here, under historic practice, the technologist is almost certain to be defeated by tradition, unless the judge and jury have some inkling of the new potentials at stake. Finally, there is the class of crimes, already indicated, in which the use of mechanical and chemical devices are involved. If then some technologist should turn the tables on lawyers and apply the rationality and efficiency of his science, a new and more realistic analysis and classification of the law would certainly ensue. There are good reasons



for a new consideration of all law and judicial procedure in the light of engineering science.

**A Comparison of Judicial and Technological Procedure.** It may strike the reader as strange, in view of the above description of court-room procedure, but there is a certain similarity between the avowed purposes of the judicial process and technology. Both set up purposes in advance. The purpose of law enforcement is to bring about a certain state or condition of things or a certain routine of conduct. Necessary to the realization of this purpose is an exact knowledge of the relevant facts in the case; and one of the prime objects of judicial procedure is, or should be, to establish these facts beyond dispute. This is the procedure followed by technology at work. It fixes an object or purpose in its plans, it ascertains the physical laws governing the operation, it attains its object by appropriate methods, and it then tests the result. Advance knowledge of purpose, ascertainment and use of relevant facts, and application of exact knowledge to ends are indispensable to technology at work and to procedures in law enforcement.

**Historical Judicial Procedure Tested by Its Own Logic and by Science.** From the above pages on judicial organization, the election of judges, and court-room procedure, it appears that, in numerous classes of cases, judges and juries are technically incompetent to disclose, verify, and authenticate the technical facts necessary to the determination of truth in the matters involved. The methods of selection, as well as the lay character of judges and juries, militate against competence in highly complicated issues of exact science. To the engineer accustomed to laboratory procedure in the discovery of truth about particular matters, court-room procedure seems queer indeed. In a large number of judicial cases, the judge appears to act as a kind of umpire at a battle of legal wits. He is supposed to be a technician in the field of his operations and to be concerned with the attainment of the objects of the law enforcement. Yet he often

does little more than preside at a contest of lawyers, in which winning the case, with little or no respect to the ends of law, is the dominant motive. And this contest is governed by highly technical legal rules, many of which are at best only remotely connected with the ascertainment of the truth of the business in hand. In the selection of jurors, too much knowledge of the issues at stake or the possession of any opinion about them is usually a disqualification rather than a qualification for choice.

Nor is the quest for evidence by the examination of witnesses conducted in the spirit of natural science. Verbal tricks are common and the intimidation of witnesses is not unknown. Evidence that is highly relevant is constantly ruled out on technical legal grounds. Trapping witnesses by ingenious twists and shouting at them are common to courtroom procedure, especially in the lower ranges. Often even less calculated to develop the truth of the business in hand are the arguments of the lawyers to judge and jury. Oratory, wit, sarcasm, cleverness, and appeals to passions are common, in civil as well as criminal cases; and it cannot be said that such devices are calculated to disclose the truth and make it prevail. Technology, on the other hand, in the attainment of its objects makes a different approach and employs different methods. Its prime concern is with the truth of the matter in hand, with the disclosure of the relevant facts; it makes no appeals to confusing sentiment and has no rules foreign to the ends established—the attainment of the object before it. Oratory, sarcasm, and appeals to sentiment, technology regards as not only irrelevant but also as positive enemies to the discovery and application of truth.

**Precedents and Technology.** Nowhere is the difference between the judicial and the technological approach more striking than in the points of reference and manner of reasoning. Judges reason from precedents. A new set of facts appears. In dealing with it judges search for a kindred set of facts and appropriate decisions and apply old rulings

to the new problem. Often they have to strain thought and logic in an effort to apply the precedents to the strange situation. Thus railroad decisions grew out of decisions made when stage-coaches were the chief instrumentalities of passenger transportation on land; decisions on petroleum property rights are connected up with the land law of agriculture. Technology, on the other hand, does not find a thing "right" because it is in line with something that once existed, but simply because it "works" as expected or planned. It does not have to be "logical" or consistent with respect to old practices, when new practices produce the desired results in a more efficient manner. And technology, which in its field is so indifferent to old methods, is the greatest force in American society creating new situations and new sets of facts for judicial action. It would seem natural, accordingly, to employ more of the engineering spirit and method in judicial procedures, especially those involving technological questions.

**A Possible Task for Technology.** Up to the present, technologists have given little consideration to law and law enforcement, although they are deeply involved in such matters at every turn. They have done little or nothing to make their conception of rationality and efficiency prevail at law, but have freely allowed a profession built on traditions, formal classifications, legal fictions, and historic theories to make the law applicable to technical property and uses. They have accepted with little questioning the procedures employed by courts and lawyers in the trial of cases—cases supposed to be concerned with the ascertainment of facts and the attainment of objectives. If the rationality and laboratory methods of exact science were applied to those branches of law in which technology is most directly involved, new classifications of law would emerge (above, p. 119), the specialization of courts (above, p. 181) would increase, and the procedure of judges and lawyers would undergo radical changes. Is there any reason in the



nature of things why technologists should not take an interest in law and procedure which affect them so vitally? Their failure to do this may be ascribed to the narrowness of their training, but as they move outward in their thought (above, p. 8), it is highly probable that they will turn the tables on the lawyers. This does not mean that all law, involving as it does human sentiments and values, can or will be reduced to an exact science, but that the parts of it concerned with technology could and should be brought more closely into conformity with the nature and methods of exact science.

## CHAPTER VII

### EXECUTIVE PROCESSES OF LAW ENFORCEMENT—ADMINISTRATION

As pointed out in the previous chapter, the distinction between judicial and executive processes of law enforcement is formal, not substantive. It may be ascribed to the simple fact that public officials bearing different titles are engaged in carrying constitutions, statutes, and administrative rulings into effect. It is for convenience that the distinction is observed in this volume.

#### CHIEF EXECUTIVES

**The Idea of the Responsible Head.** Every unit of government, except in counties and minor communities, has a chief executive. These officers range in dignity from the President of the United States to governors of states and mayors of cities. Even among the counties and cities having the commission system (p. 99) there is discernible a movement in favor of instituting the single-manager plan which vests executive powers in a chief officer chosen by the legislative board or council. A few states have made provision by law for this change in our historic methods, and it is already installed in a few counties. Judging by the momentum of the movement the practice will spread rapidly in the coming years. It looks as if the idea of the single responsible head for each division of government might become universally accepted before the twentieth century has advanced much further. The theory is that all parts of public administration in a given government are tied together thereby and that public functions are more effectively carried out when a single chief assumes general responsibility.

**Choice of the Chief Executive.** Two methods are employed in the choice of executives: popular election and selection by the legislature. The President of the United States is chosen indirectly by popular vote; every four years the voters of each state choose a number of electors equal in number to its representation in Congress, and these electors, by plurality vote, select the President. This is the form. As everyone knows, however, each of the political parties nominates candidates for the presidency, and its electors for whom voters cast their ballots in the respective states are mere pawns who cast their votes according to party dictates. Governors of states are elected directly by popular vote. So are the mayors of many cities. On the other hand in a large number of cities the chief executive, known as the city manager, is chosen by the city council or commission whose members are elected by popular vote.

**Training of Executives.** Most of the Presidents of the United States have been former military officers or lawyers. In the lives of many Presidents these professions have been combined. This has been the rule even since the old order of agriculture and handicrafts was revolutionized by technology. Not a single industrialist, labor leader, or engineer has been called directly from his vocation to the White House. Several Presidents, as military men, had received engineering training, and Herbert Hoover had been educated for the profession; but none of them was chosen primarily for his engineering qualifications. It may be said, therefore, that the way to the presidency has not led through engineering, either operative or managerial, despite the highly technical character of modern administrative functions.

Conditions analogous in many respects prevail in the states. A study of state governors between 1909 and 1931 made by Samuel R. Solomon shows that of the 209 governors, whose careers could be traced, 86 had been lawyers; only seven were recruited from engineering and forestry; the remainder included seven manufacturers, one laborer, a few



farmers, and several editors and real estate agents. Only in cities that have managers chosen by the councils are we apt to find engineers ordinarily acting as chief executives. In cities, it seems, the technical character of administration is recognized and technical training is regarded as necessary to the efficient management of public business. Whether the training given in engineering schools or the very discipline of the profession is responsible for the small number of engineers in high executive positions—that is, runs against the spirit of public leadership—is a matter that cannot be easily determined. Whether engineers will play a different rôle in the government of the future will depend, in some measure, on the breadth of their views.

#### TYPES OF ADMINISTRATIVE ORGANIZATION

**Size and Nature of Modern Governments.** Modern executive departments are of prodigious dimensions. More than 600,000 persons are normally employed in civil occupations by the national Government alone. Compared with the Ford Motor Company, with its 250,000 workers scattered throughout the world, the General Motors Corporation with 175,000, or the United States Steel Corporation with 200,000, the national Government is indeed a giant concern. In its offices labor all classes of skilled technicians as well as politicians, clerks, and typists. Astronomers observe the stars in order that accurate time signals may be disseminated all over the country. Surveyors map mountains and coasts. Chemists analyze foods and drugs to protect the public health. Doctors conduct researches in contagious diseases. Aviators race through the skies for the Army and Navy. Sailors handle special craft in quest of derelicts or icebergs. Radio experts build and operate radio beacons and radio compasses for the guidance of navigators by water and air. Meteorologists record weather data and prepare forecasts from the same. Mechanical engineers operate a series of huge testing machines in the Bureau of

Standards. And so we might continue. Additional tens of thousands of civil servants, including engineers and scientists of every division, are employed in states, counties, and cities.

Although the magnitude of the governmental system had long been known in a general way, no comprehensive statistical description of it appeared until 1932, when William E. Mosher and Sophie Polah published their survey, "Extent, Costs, and Significance of Public Employment in the United States" (Supplement to the *National Municipal Review*, January, 1932), covering Federal, state, county, city, town, village, and school governments. The general conclusions of their investigation are summarized in the following table:

SUMMARY TABLE—NUMBER OF EMPLOYEES IN GOVERNMENT SERVICE, COMPENSATION, AND OPERATING BUDGET OF 1926 <sup>1</sup>

JURISDICTION	NUMBER OF FULL-TIME EMPLOYEES	NUMBER OF PART-TIME EMPLOYEES	TOTAL COMPENSATION FOR FULL- AND PART-TIME EMPLOYEES (IN THOUSANDS)	OPERATING BUDGETS (IN THOUSANDS)	COMPENSATION DIVIDED BY OPERATING BUDGET (PERCENTAGE)
Federal . . . . .	848,349	No data	\$1,200,867	\$1,715,397	70%
States { Administration . . . . .	153,226	137,000	218,492	602,558	36
{ Education . . . . .	68,123	.....	114,979	192,898	60
Counties . . . . .	142,415	278,000	258,952	601,310	43
Towns and cities . . .	534,897	527,000	858,817	1,534,785	56
Public school system	936,686	No data	1,246,542	1,537,874	81
Totals . . . . .	2,683,696	942,000	\$3,898,649	\$6,184,822	63%

Although no minute survey of the scientific and technological services of American government in its entirety has ever been made, some notion of the nature and variety of these services can be obtained from the following list of fields covered by the Professional and Scientific Service of the

<sup>1</sup> Data for the Federal Government are for 1926-1927.

Federal Government (Departmental data as of May 15, 1931, and field service data as of October 1, 1928): <sup>1</sup>

*Agricultural and Biological Science Group*

Agronomy	General agriculture
Animal husbandry	Grazing research
Animal parasitology	Horticulture
Animal physiology	Land classification
Aquatic biology	Market milk improvement and sanitation
Bacteriology	Microanalysis
Biology	Microbiology
Botany	Mycology
Cytology	Nematology
Dairy husbandry	Park naturalist work
Dairy manufacturing	Pharmacognosy
Entomology	Pharmacology
Forestry	Pharmacy
Forest ecology	Plant pathology
Forest experimentation	Plant physiology
Forest products technology	Plant quarantine
Forest region administration	Silviculture
General administrative	Zoölogy
Food and drug	
Plant industry	
Plant quarantine and control	
Scientific work	

*Physical Science Group*

Astronomy	Metallurgy
Chemistry	Meteorology
Cryptography	Nautical science
Food and drug inspection	Physics
Forest products technology	Soil science
Geology	Technology
Mathematics	

*Engineering Group*

Architecture	Cadastral engineering
Architectural engineering	Cartographic engineering
Automotive engineering	Ceramic engineering

<sup>1</sup> *University Training for the National Service* (University of Minnesota Press, 1932).



Building superintendence and inspection	Chemical engineering
Common carrier valuation engineering	Civil engineering
Construction engineering	Marine engineering
Electrical engineering	Mechanical engineering
Fire-prevention engineering	Mining engineering
Geodetic engineering	Naval architecture
Highway bridge engineering	Ordnance engineering
Highway engineering	Parachute engineering
Hydraulic engineering	Petroleum engineering
Hydrographic engineering	Radio engineering
Industrial engineering	Sanitary engineering
Land appraisal	Signal engineering
Landscape architecture	Structural engineering
Lighthouse engineering	Topographical engineering
Logging engineering	Traffic engineering
	Valuation engineering

*Dental Science, Medical Science, and Veterinary Science*  
*Groups (subdivisions omitted here)*

**Straight Line Organization.** Such complex aggregations of human beings can only function as purposeful entities when subjected to close direction from above. Consequently, specialists in administration have struggled valiantly to develop efficient means of supervision. As a final product of their efforts, several varieties of structure have been instituted. Taking engineering branches of the public service by way of illustration, we turn to an examination of practice. A very common type of headquarters management is the so-called "line organization." In this arrangement, as represented by the Federal Department of Commerce, an uninterrupted chain of responsibility may be traced. At the top is the Secretary of Commerce, in charge of the entire Department. Below him are the staffs of several "bureaus" into which the unit is divided—fisheries, lighthouses, navigation, mines, patents, steamboat inspection, coast and geodetic survey, standards, census, foreign and domestic commerce, and aeronautics. At the head of each "bureau" is a chief who reports to the Secretary of

Commerce and receives instructions from him. In turn, each "bureau" is divided into a number of smaller bodies. Thus the officer in charge of the aëronautics branch has five men directly answerable to him—the directors of air regulation, administration, airways, helium, and aëronautic development. The arrangement continues all the way down the line.<sup>1</sup> Below the director of aëronautic development are five groups—the airways mapping section, the airport section, the aëronautic research division, the aëronautic information division, and certain special research committees. Just to indicate the minuteness of the process, one more step will be mentioned. Within the aëronautic research division are five sections—radio, lighting, wind tunnel, engineering, and aircraft engine. This line organization resembles that of the Army, where each officer is in command of a group of men and is in turn directly responsible to his immediate superior, and so on up to the Commander-in-Chief.

**Commissions or Boards.** Differing markedly from the line organization of single-headed divisions and subdivisions, just described, is commission or board management. A commission or board consists of a group of persons who determine policy and prepare orders through joint deliberation. Arguments in favor of the method are based on the assumption that questions of grave public importance should not be settled at the whim of a single executive, who might be wrong, but should be controlled by a jury of diversified individuals supposed to be capable of arriving at sane compromises.

Bearing this in mind, one finds it easy to understand why commissions are being employed for certain special services. For example, the regulation of public utilities—water, gas, electric, and transportation—involves the fixing of rates as well as service standards for millions of dollars worth of

<sup>1</sup> In this set-up there is close coördination with other branches of administration (see p. 224).

capital outlay. The protection of the small consumer must be balanced against the desire of investors for increased revenue. Here is ample opportunity for conflicting views. In modern practice public-utility regulation and other governmental activities that are semi-legislative and semi-judicial are usually in the hands of commissions. As for position, a board is generally placed at the top of the administrative structure, with line organizations occupying a subordinate position. Only on rare occasions, as in the case of Federal plant quarantine work, does one find a committee discharging functions at the beck and call of a superior department or bureau head. Nor is this surprising, for the purpose of a deliberative commission would be defeated if the conclave merely had to carry out strict instructions from above.

To preserve the merits of open discussion without making boards unwieldy calls for good judgment. In an attempt to strike a happy medium, commissions of many different sizes have been tried. Small groups are common, a majority of the states placing the regulation of public utilities in the hands of boards of three men each. On the other side, the desire for bringing a wider range of views to bear on the issues at stake has occasionally resulted in the establishment of larger groups. A few public-utility commissions are composed of five or seven men, while the Interstate Commerce Commission of the Federal Government contains eleven.

Whether large or small, the purpose of the board being to reflect rival opinions, its prime object would be defeated if it consisted entirely of individuals possessing the same political faith. Consequently, it is customary to provide that the membership shall be divided as equitably as possible between the two major parties. Thus, Federal law specifies that not over six of the eleven Interstate Commerce Commissioners shall be of the same party. To insure a measure of continuity in policies, only a limited portion of certain



boards goes out of office at any one time; by law not more than two members of the Interstate Commerce Commission may be retired in a given year. From the above figures it is also evident that the general tendency is to create bodies composed of an odd number of persons—a safeguard against tie-decisions.

**Line and Staff Agencies.** Combining certain of the advantages possessed by both the line and commission types of organization is the so-called line and staff system. An outstanding example of the employment of the latter arrangement in a technological agency is afforded by the United States Army. The basic management of the military service is of the strictly line variety. Generals issue orders to subordinates who in turn pass the word to their subordinates, and so on down to the lowest rank. But attached to the top of the structure is a separate and distinct body, the Army General Staff. Essentially, it is a commission composed of experts who devote themselves to research. By watching the latest developments in tactics and equipment, they seek ways and means of improving the efficiency of the military machine. However, they have no executive power to issue commands, being thereby differentiated from usual board members. They merely submit their findings to the Secretary of War, with recommendations to guide his actions. As the responsible chief of the War Department, he is free to do whatever he wishes with these suggestions, subject to orders from the President.

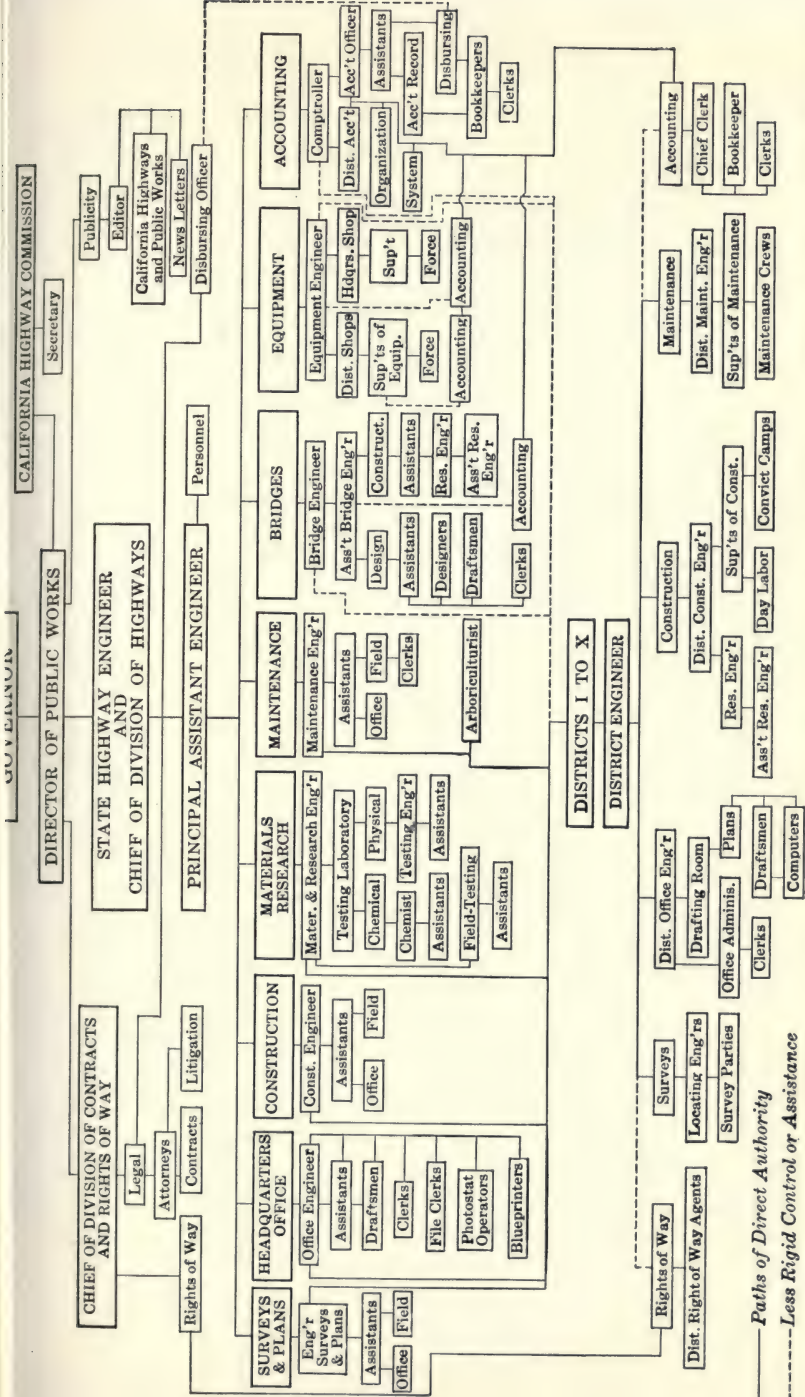
This unique combination preserves the qualities of swift action and direct responsibility possessed by line organization, while at the same time it incorporates the deliberative merits of the board. The desirability of such a union is especially great in military service. Quick steps must often be taken in the field to avoid disaster. But the head of the War Department is a civilian, unacquainted with technical matters. Furthermore, as manager of a vast agency, engaged in the building of river and harbor improvements, the up-

keep and repair of hundreds of thousands of dollars worth of fortifications, and the supervision of large bodies of men, he is necessarily busy with routine and not free to engage in extensive research or discussion. As layman and routinier, he needs advice. And the General Staff is there to give it, on a full-time basis, without being able to delay work by holding up orders. In like fashion, the state of Wisconsin has recently created an executive council of twenty members to confer with the governor of the state, but it possesses no power to issue commands. Such developments, though not widespread, are gaining favor, as indicated by the creation of advisory bodies in connection with the National Recovery Administration in 1933 (below, Chapter XVIII).

**Geographical Districts for Field Operations.** For the discharge of administrative duties in the field, a type of organization differing fundamentally from that for headquarters personnel is necessary. Instead of providing for the detailed field management of many undertakings from a central desk in the capital, it is the practice to create a number of geographical districts and establish an administrative unit to assume control over the work in each of the specified regions. Each such agency is on a par with all its fellows in rank, and performs substantially similar duties.

The United States Lighthouse Service, for example, divides its empire into twenty-one districts, each in charge of its own superintendent, responsible to the chief of the system in Washington, D. C. Two districts are entirely inland, maintaining aviation lights. Six are partly coastal, caring for marine and aeronautical lighting. The remainder devote themselves solely to marine activities. Typical of district jurisdictions are the following: for the first, the waters of Maine and New Hampshire; for the nineteenth, the waters of the Hawaiian, Midway, Guam, and Samoan Islands.

Many widely scattered technical services resort to the same arrangement. River and harbor work carried on by the United States Army Corps of Engineers is split up



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*Paths of Direct Authority*  
*Less Rigid Control or Assistance*

TYPICAL ORGANIZATION CHART FOR AN ENGINEERING AGENCY

Administrative organization of the Division of Highways, California Department of Public Works, in 1932.

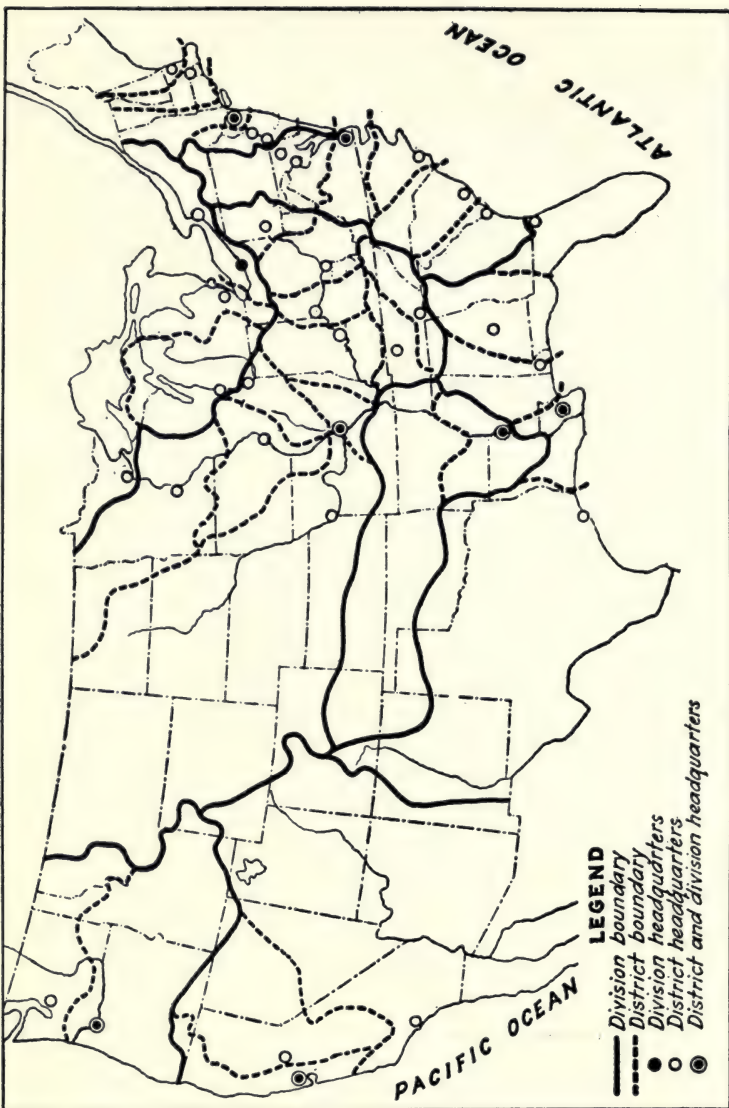
*Courtesy of the California Division of Highways*



*Courtesy of the Engineering News-Record*

# ADMINISTRATIVE DISTRICTS FOR ENGINEERING FIELD WORK

Map showing divisions and subordinate districts for carrying on the field operations of the Army Corps of Engineers, as of the year 1929 (see opposite page)



among eight Divisions, such as the North Atlantic and the Gulf of Mexico sections, which in turn are divided into districts. In the same way, state highway construction is commonly distributed among minor regional bodies. The number of geographical entities subordinate to headquarters depends upon the extent of the works involved. It also bears a relation to the number of regional chiefs that can be simultaneously watched from one spot with efficiency. Other things being equal, it is easier to keep an eye on eight than twenty-one inferiors.

Inevitably, a problem has arisen as to the precise degree to which field offices and the capital should be interconnected. Where the distances between the two are great, as from the Hawaiian headquarters of the nineteenth lighthouse district to the central staff of the Lighthouse Service at Washington, D. C., it is wise to grant regional agents a considerable measure of autonomy. Such a policy cuts red-tape and saves days of waiting for the completion of official correspondence before taking action. It also enables men in close touch with local peculiarities to handle their special problems efficiently without being hampered by too much interference from distant chiefs, unfamiliar with the unique circumstances involved. Conversely, where main and field offices are closer together, a somewhat larger degree of centralized management is feasible.

**Unitary and Multiple Plans.** Regardless of the precise extent to which authority is shared among central and field forces, some connecting lines must be established. Two methods of tying them together have been devised. Under the unitary plan, the head of a given district has charge of all the inferior bureaus and divisions within his area. If any subordinate body wishes to get in touch with the capital, it must communicate through him. The Army engineers use this scheme, the commanding officer of each Division being directly responsible for all activities in his jurisdiction. The alternative arrangement is known as the

multiple plan. It provides that each suboffice in a given district is primarily responsible to the corresponding suboffice at the capital. For example, a machine-shop in a field warehouse might be under the control of the chief of the machine-shop bureau at central headquarters, rather than under the directing head of the district in question. The Navy Department once tried the multiple plan in connection with its branch shipyards.

**Disadvantages of the Multiple Plan.** While the multiple plan furthers specialization by putting like activities under the same unit, drawing occupational lines from the capital to the most distant field stations, it has marked disadvantages. Upon occasion it has allowed the several groups in a given district to become so independent of one another and so little under the control of the district commandant, that one unit has refused to employ the perfectly good facilities belonging to another. Just such a situation arose in the Navy where it was found that there might be two or more paint shops in the same shipyard, managed by different subordinate organizations, even though one might suffice. Resulting duplications of plant reached such proportions that the multiple system was finally abandoned in the Navy and replaced by the alternative unitary arrangement.

**Coördinating Bodies.** No matter how skillfully central or field offices are organized, there is bound to be some overlapping among agencies. Several Federal units are busy with mapping enterprises—the Geological Survey of the Interior Department and the Coast and Geodetic Survey of the Department of Commerce, for instance. Each performs an essential duty for the Department in which it is located. Since the Secretary of the Interior must handle the leasing of public mineral lands, he requires the geological data furnished to him by his subordinate research unit. On the other hand, the Secretary of Commerce, regulating and aiding navigation on the seas, finds Coast and Geodetic Survey hydrographic charts of great value. If both bodies were



brought together, one department or the other would suffer a partial dismemberment. If they remain separate, there is a loss of efficiency, for one complements the labors of the other.

Out of just such predicaments has arisen a series of coördinating agencies. One such body is the Interdepartmental Mail Board of the Federal Government, which discharges the important function of letting national contracts for the carriage of the mails by water. Naturally the head of the Post Office Department is an interested member. Properly included in the membership of the Board is the Secretary of the Navy; for mail payments are granted with a view to building up a merchant-marine auxiliary to support the regular combat forces in times of peril. Equally essential is the presence of the head of the United States Shipping Board Bureau in the Department of Commerce, operator of vessels constructed during the World War for emergency use, but still running under Federal management. For practical reasons also, the Secretary of Commerce, who controls the licensing and inspection of American steamships and their crews, is a partner in the Mail Board. Separately each man is free to devote himself to his individual tasks; collectively all try to solve the problem of putting the American flag back on the high seas. In many other fields coördinating boards are employed. Generally speaking, their names afford clues to their real purposes. The Permanent Conference on Printing, the Interdepartmental Patents Board, the Federal Board of Hospitalization, and the Federal Traffic Board seek to eliminate waste motion in their respective domains.

Economies of many kinds may be secured through such devices. Suppose a coast-guard station, a plant quarantine depot, and an Army post lie close together in a given district and have common needs for food, gasoline, and other supplies. By coöperating they can pool their resources and save money through quantity purchases. Lockmasters for

the Army Corps of Engineers, in charge of operating canal gates on a Federal waterway, have served as river stage observers for the weather bureau, thus obviating duplication in personnel. In like manner the Navy has offered some of its unused storage warehouse space to the Veterans' Bureau. In like manner the Federal Aëronautics Branch receives assistance from other Federal agencies—its airway facilities are manned by the Lighthouse Service and its airway maps are prepared by the Coast and Geodetic Survey.

### ADMINISTRATIVE REORGANIZATION

**Growth in Executive Agencies.** The above discussion of the various types of administrative organization is only a preliminary to the study of fundamental administrative structures as a whole. These structures were once relatively simple, in the first few decades following the American Revolution. But the coming of technology marked a great change. As railroads and steamboats expanded their operations, Federal and state regulation of the new instruments became necessary. Developments in sanitary engineering and the art of public health control brought in their train the establishment of innumerable water-works and sewerage systems under municipal ownership. The telephone and telegraph, allied with neighboring inventions in the field of electric lighting and power, resulted in throwing supervisory tasks upon cities and states. "Horseless carriages," at first the subject matter for uproarious jokes, soon made their utility felt throughout the land, calling forth the now famous movement for good roads. Millions upon millions of dollars were subsequently laid out to construct routes over which motor cars might run with ease. As architects turned their energies to modern steel-skeleton designs, building legislation, elevator and fire inspection, and related duties were permanently fastened on local authorities as indispensable to public safety. Crowded cities, their streets congested by vehicular traffic and jammed

by milling thousands of people as skyscrapers unloaded their human freight at the close of the day, proved so ill adapted to modern life as to give rise to striking projects for city planning. Such trends, and many more, inevitably multiplied administrative functions as the economy of technology destroyed handicraft economy.

As fast as additional duties were thrown upon governments, independent agencies were generally created to discharge them; rarely were the tasks assigned to existing departments or boards. The experience of Illinois may serve to illustrate the process. There the office of state geologist was founded in 1851, followed by a canal commission and an industrial university in 1867. Shortly afterwards a railroad and warehouse commission, a board of health, a board of pharmacy, and a board of dental examiners were established. In 1893 a mining board and several separate mining positions were created. Between the Spanish War and the World War, a food commissioner, a board of prison industries, a civil service commission, a highway commission, a food standards commission, and a mine rescue commission appeared upon the political scene.

Throughout the land developments of this kind were taking place. Thus it happened that nearly every important governmental unit in the country became a bewildering collection of boards, commissions, and agencies. Illinois, prior to 1917, had over a hundred distinct bodies—many of them under the more or less “direct” supervision of the governor; Michigan had 116 as late as 1920; New York was the possessor of 187; Massachusetts was weighted down with 200; the Federal Government, besides its regular Departments, also had numerous independent agencies and commissions. A state was “poor indeed” that did not contain fifty or more. Obviously no chief executive could be fairly required to assume responsibility for the individual actions of a hundred or more equal divisions of administration.

Supervisory difficulties would not have been so great if



all or nearly all of these agencies had possessed only one head. Such, however, was not the case, for a general tendency towards the adoption of the commission or board type of supervision was everywhere manifest. In view of the fact that private companies and institutions were accustomed to entrust control over the management of their affairs to boards of trustees or of directors, the same practice in government did not seem to be strange. But in time students of administration came to the conclusion that the movement had swung too far, for even in lines of governmental activity where a single individual could act quickly and safely, unwieldy groups of men were frequently found in charge. Previous to 1921 there were thirty-five commissions in Ohio, as against fourteen agencies under the direction of separate chiefs. As administrative structures became crowded with boards, lines of responsibility grew more and more blurred.

Amid such circumstances even if the chief executive were a super-man, capable of watching simultaneously a hundred or more subordinate boards or individual heads with an eagle eye, he might still be unable to achieve efficiency in administration. Duplication in the work carried on by separate agencies, created at random, would remain as a serious handicap. Professor W. F. Dodd cites Illinois, previous to 1917, as providing examples of such lost motion. Industrial accidents had to be reported to one or more of *five* separate and distinct governmental organizations, depending upon circumstances. Unfortunately the average employer could not always be sure with which of these units he should make contact in his particular case, so confusing was the set-up. Nor was his task made easier by the fact that it was usually necessary to prepare a different type of statement for each of the supervising offices. Human nature being what it is, persons caught in the web of the "system" naturally became exasperated at the muddle and often chose to neglect their responsibilities for rendering an account-

ing. Luck was often on their side, because the prevalence of crossed lines of responsibility among the competing administrative entities meant that omissions were hard to trace. The conditions that prevailed in Illinois were duplicated elsewhere.

**The Reorganization Movement.** Inefficiency, resulting from a luxuriant growth of independent agencies, eventually aroused the ire of critics. When F. W. Taylor, in 1903, announced certain broad principles of scientific management, he unconsciously laid the foundations for a significant political movement. Although his attention was directed towards remedying defects in factory and business administration, the possibility of applying his ideas to governmental organizations was quickly realized. In 1906 the New York Bureau of Municipal Research was created, with a view, among other things, to exploring such opportunities in government to the full. Before long this private institution had stirred up a vigorous sentiment in favor of the overhauling of cities and states, and finally, the Federal Government itself. Receiving official support for its labors, it conducted a series of surveys.

On invitation of the state of New York, the Bureau of Municipal Research reviewed the state's complex agglomeration of agencies and prepared designs for simplification, in connection with the constitutional convention of 1915. Entering the Middle West it analyzed the tangle of government in South Dakota and offered numerous recommendations for reconstruction. At the request of the governor of Virginia it studied the governmental system of that commonwealth and prepared a program of reorganization. One report followed another in steady succession, arousing public interest in the problem of administrative organization for the efficient discharge of public responsibilities. So popular did the pioneering work of the Bureau become that similar private bodies were established in the leading cities of the country.

As the efforts of private reformers gained headway, governmental commissions were created to provide officially-added impetus. One of the earliest as well as one of the most important was President Taft's Efficiency and Economy Commission, organized in 1910 to review the entire Federal administrative structure. The year 1921 saw the establishment of a second agency charged with a kindred duty—the Congressional Joint Committee on the Reorganization of Government Departments. Various states also set up temporary bodies to survey their respective executive agglomerations. The Illinois committee on efficiency and economy, for instance, made a notable report of 1,000 pages in 1915, including a comprehensive plan of consolidation. Other states followed until within fifteen years about one-third had utilized the services of such agencies in a search for efficiency and economy. So significant were the results of such work that in several cases permanent bureaus were provided to engage in a continuous investigation of their associates in administration—for example, the Federal Bureau of Efficiency at Washington.

**Opposition of Bureaucrats to Change.** Opposition to the movement for administrative reconstruction appeared among public officials who did not want to be disturbed. Herbert C. Hoover, while Secretary of Commerce, once said: "I do not believe that any government reorganization will ever take place that will meet with agreement among the existing heads of the government. . . . The men who are at the head of various bureaus and secondary functions of the government believe honestly and earnestly in the purpose of their service, and they are bound to object to any change which it seems to them would decrease their activities, reduce their personnel, or require them to take a less important position in some other grouping." When it was once suggested that the Hydrographic Office and the Naval Observatory be transferred from the Navy Department to some civilian unit, the shift was opposed by naval men. As



the chairman of the committee investigating Federal reorganization remarked at the time: "The only change with respect to the Navy that the Secretary of the Navy even appeared to consider favorably was the proposal *to add to the Navy* the Coast Guard Service." Bitter strife among officials, each intent on increasing or at least retaining his rank and prestige, has often prevented well-laid plans from going through to completion.

**Examples of Reorganization.** So strong was the reorganization movement, however, that it triumphed over the inertia of government officials on more than one occasion. For a decade, it is true, reformers pleaded in vain for a chance to place a comprehensive scheme of administrative reconstruction in working order. But at last, in 1916, their labors resulted in action, for in that year the Illinois legislature, hard pressed by Governor Frank O. Lowden, authorized a general overhaul of state agencies. The success of this experiment lent prestige to the drive, with the result that other states quickly fell into line. In 1919 Idaho, Nebraska, and Massachusetts came into the revision movement. Emboldened by the pioneers, other states in the following order reconstructed their administrative systems: Washington, Ohio, California, Maryland, Pennsylvania, Tennessee, Vermont, Minnesota, South Dakota, New York, and Virginia. Meanwhile the reorganization of city and county executive agencies was effected in different parts of the country. Even the problem of rebuilding the Federal Government was boldly tackled, as a need for economy in the largest of our units was being felt; and at length in 1933 blanket authority to reconstruct the administrative system was exercised by President Roosevelt.

**Basic Principles of Administrative Organization.** Administrative organization designed in the interests of efficiency and economy rests on a few great principles. The first of these is that the bulk of small independent agencies should be grouped into a few large departments. The total number

of the latter should be sufficiently small (not over twelve or fifteen) to permit the chief executive to supervise and maintain contact with them. State reorganizations have invariably involved this integrating process. When Illinois had its comprehensive reconstruction in 1916, over 100 distinct agencies were consolidated into nine departments. New York squeezed the duties of over 180 bodies into eighteen departments. Pennsylvania consolidated the activities of 105 in fourteen departments and three independent commissions. California brought fifty-eight entities into nine departments.

The second basic principle or idea is that each individual department should include only authorities engaged in carrying on related phases of a single essential function. On this principle, canal, road, and public building units are logically assembled in a department of public works, and offices devoted to farm research, insect control, and market news are placed in a department of agriculture. Identical practice is then followed with respect to the internal arrangement of departments. Each subordinate bureau should be confined to one phase of the general function discharged by the department in which it is located.

According to the third basic principle of administration, the functions of the various agencies should be examined with a view to determining on a rational basis whether they may be more effectively discharged under the direction of a board or of a single individual. We have already analyzed the advantages and disadvantages of each (p. 217). Taking into account these merits and defects, political scientists have come to the conclusion that where purely administrative duties are involved, as in the management of a waterworks, an electric system, a canal, or the issuance of automobile licenses, responsibility should be placed squarely on the shoulders of a single officer. Where rules are to be made affecting millions of dollars worth of property, as in the field of public utility or factory regulation, commis-

sions are deemed more suitable; but even here one of the commissioners should be made primarily responsible for the *execution* of rules and orders. In view of the fact that previous to the reorganization movement most governments employed boards more or less indiscriminately, reform usually has resulted in the application of the ax to a large number of councils. Witness the destruction of seventeen, in charge of an equal number of charitable institutions in Illinois, during the administrative revision of 1916.

Running counter to the general tendency towards restricting the use of commissions in projects for reorganization, a few states continue to rely heavily on the board plan. New Jersey is one of them. Although that state has consolidated all its major offices in a few departments, it has placed others under commissions that are substantially independent. However well constructed internally, the latter agencies have little kingdoms of their own, and are under slight responsibility to the governor.

Where administrative agencies are consolidated in a few departments, each headed by a single responsible director, it becomes possible for the chief executive to form a "cabinet." If the President of the United States, for example, wishes to obtain information on the general condition of his regular administrative machine, he has only to summon the men in charge of the ten Federal departments. On the Federal analogy, a Governor's Council was created in 1927 for California; at least once a month the directors of the nine departments of administration assemble at Sacramento. New York and a few other states, after their reorganization, also adopted the idea. Even cities make extensive use of the scheme.

At "cabinet" meetings questions of broad general policy may be discussed. Another end may be achieved: by gathering in common, better coöperation and coördination among branches of the service may be secured, resulting in a reduction of friction and duplication. Nor are mayors, governors,



and the President the only executives who hold sessions of their subordinates; district engineers for the California state highway department come together periodically for conferences at the capital.

**Results of Reorganization.** Interesting indeed have been the results of state reorganizations. Following closely upon the heels of a general executive overhauling in Nebraska, a special session of the legislature cut down appropriations by \$2,000,000 for the ensuing two-year period. In the second half of the biennium, the tax rate shrank a third. Yet this saving was not detrimental to the service but primarily represented the cost of lost motion eliminated through reform. Likewise encouraging was the experience of Vermont where the governor reported several marked changes for the better after reconstruction. Besides noting a reduction of ten per cent in the number of employees and a large net gain in economy, he was able to say that the work of the state was being carried on more efficiently, that much red-tape had been cut away, and that the structure had proved more flexible. Tennessee, too, was at first fortunate with her revision. For the first biennium after consolidation, official appropriations were \$1,200,000 less than for the previous biennium. At the end of four years of operation, a deficit of \$2,900,000 inherited from the former administration had been wiped out and its place taken by a surplus of over a million dollars. Evidently, then, the hopes of advocates of scientific management for political institutions have some justification in experience.

However, administrative reorganizations, like most types of reform, come about at those rare intervals when public temper is aroused, and then suffer from the decline in civic interest which usually follows. Administrative systems, once established, do not run under their own momentum nor necessarily according to the intention of the designers. After revisions in administration have been made, politicians and legislatures often throw experience to the winds.

and revert to their old habit of creating an independent agency to take care of each new function instead of fitting it into some existing department. Moreover, heads of departments, bureaus, and divisions correctly aligned in a scheme of responsibility may be subjected to the spoils system and the whole structure turned into an engine of corruption. There is nothing in a sound administrative set-up which of itself assures efficiency in performance. Such a set-up is an instrument, not a guarantee, of effective government. And respect for the facts in the case requires one to report that some of the states which reconstructed their administrations have made dishonorable and wasteful use of the new governmental systems.

#### APPOINTMENT AND REMOVAL OF GOVERNMENT OFFICERS

**Personnel Management Concerns the Engineer.** Whatever the nature of administrative organizations, in general or in detail, thousands upon thousands of persons must be chosen to fill the various posts of American government. A study of the total number of full-time employees in the public service—Federal, state, and local—places the figure at approximately 2,700,000. Included in this summation are thousands of technical positions: the national administration alone had 6,791 engineers on its rolls on June 30, 1931. The existence of significant opportunities for employment lends a touch of genuine professional interest to the ensuing study of problems of personnel management in government. A knowledge of how offices are filled, what salary scales prevail, and what arrangements are made for pensions or compensation for injuries may some day prove helpful to the student. This information is not only valuable for its own sake, but it affords a basis for considering the merits and demerits of private as compared with public life, a prerequisite to a rational choice of either career.

**Popular Election.** Historically, one of the commonest ways of selecting men for government posts was by popu-

lar election (p. 65). When political activities were relatively limited in scope and simple in nature, theorists justly maintained that the democratic processes for picking men for high administrative positions often worked effectively. Even today we can find many important posts filled in this manner—the trusteeships for the Chicago Sanitary District, involving the operation of gigantic sewage disposal plants, being among them. But with the march of technology, an inevitable tide of reaction set in against the practice. In support of the new trend, Indiana put an end to the popular election of the state geologist in 1919, while New York took the same step with respect to her state engineer and surveyor in 1925. The same developments are to be seen all over the country. Several factors are responsible for the change. As governments expanded, it was increasingly difficult to maintain the original percentage of elective agents, for ballots became so long and unwieldy as to make elections little more than a joke. How could the “average citizen” study the qualifications of every person on a five-foot list of candidates? A further difficulty arose. How could a voter be expected to choose technically competent administrators when he was unfamiliar with their fields? As science and machinery continued to foster specialization, this problem loomed ever larger. Nor was the rattle and bang of campaigning an adequate method of enlightenment. For a variety of causes, popular election of administrative officers has been losing ground steadily.

**Political Appointees.** While the highest executive positions are still filled by popular election, subordinates commonly hold their posts by appointment. Where there are no special prerequisites for given offices, the incumbents are likely to be “political appointees.” The name is apt, for candidates victorious at the polls are given broad powers of choosing subordinates, being “responsible” to the voters, however, for any gross lack of judgment in the process. With exceptions, these subordinates are in turn allowed to



select many men and women to serve under them. Sometimes an administrator makes the assignment by himself, the governors of several states naming department heads at will. In other cases, the consent of the upper branch of the legislature may be necessary. Thus the chiefs of the various Federal Departments are all chosen by the President, subject to confirmation by the Senate. Legislative advice is considered to be a precaution against "tyranny" on the part of executive agents. Private organizations, as well, sometimes possess limited selecting powers. Thus in Indiana in 1923 the local dental association was endowed with the legal right of nominating candidates for the state board of dental examiners, the governor merely confirming names as a matter of routine. But whatever the methods, it usually happens that party managers or "bosses," operating behind the scenes, can in fact dictate many appointments.

"Political" assignments have their drawbacks. In view of the fact that appointing agents are popularly elected, they are under moral obligations to party colleagues. Almost the only type of reward that the average successful candidate has to offer is a well-paying post in the government. Where he utilizes the patronage at his command for compensation of this character, the practice is known as the "spoils system." It began on a large scale with the accession of Andrew Jackson to the presidency of the United States. When he rode into office, only a handful of men belonging to his particular party were working for the national administration. After reaching Washington he threw out hundreds of opponents and replaced them with his own supporters. For justification, it was urged that "to the victor belongs the spoils."

Unfortunately such sweeping changes, by putting emphasis on political faith rather than ability, may have demoralizing influences in administrative work. To show what can happen, a passage from municipal history may be cited. The general

superintendency of the bureau of water in a local department of public works became vacant. It was quickly filled by the selection of a transitman who thereby won a sudden increase in salary from \$1,880 to \$5,000 per year. At the time it was alleged that, on the basis of technical skill, many of his fellow employees were more fairly entitled to the promotion; in fact, it appeared that shortly before his advancement he had made an error in a survey that had cost the city an amount almost equal to a year's salary. It is true that many excellent appointments are made by the political process, but the risks of error and incompetence are high.

**Growth of the Merit System.** Seeking an alternative to the spoils system that would assure the appointment of fairly capable men to the great mass of administrative posts, reformers devised the so-called merit plan. This scheme provides for the selection of officers on the basis of ability, as tested by examinations, and regardless of party affiliations. Naturally, the old school of politicians mourned the change, viewing it as a death blow to patronage and hence to party unity. But after years of ardent advocacy the reformers succeeded in securing the adoption of the plan on a limited scale by the Federal Government in 1883, subsequently by many cities and a few states; and still later they won a material extension of the scope of the scheme.

**Qualifications for Candidates under the Merit System.** Appointment procedure under the merit system involves an initial determination of qualifications for given posts, especially with respect to general fitness and experience. Often definite age limits are set; in providing for the selection of junior highway engineers, California fixes the minimum age at twenty-one and the maximum at fifty; individuals under twenty-one, being minors, are unable to assume legal responsibilities; persons over fifty may not be sufficiently agile to perform field work with facility. To avoid discrimination on account of sex, a variety of offices are open to

both men and women, the latter occasionally winning the coveted places. Previous training, as well as physical condition, is also an element in determining qualifications. In the case of junior engineers, just cited, an education equivalent to graduation from college with major work in civil engineering, supplemented by one year's practical outside employment, is required. Often substantial credits are granted for exceptional experience that offsets handicaps due to lack of more formal education.

**Examination of Candidates under the Merit System.** Applicants meeting all preliminary requirements for a given class of positions are notified of the time and place at which they must appear, to take formal examinations. The test, which may be either an oral or a written one, or both, covers in detail problems typifying the work to be performed by appointees of the particular rank. After the examinations are over, the papers are graded and a record prepared indicating the relative standing of the several competitors. Sometimes the person receiving the highest mark gets the position automatically. Generally, however, a choice between a few of the best candidates is permitted. Thus the appointing agent may be empowered to pick any name he wishes from the three at the head of the list. Such an arrangement grants him some range of choice, leaving him free to select the second or third entrant if he feels that the superior character or experience of the person makes up for any slight inferiority in scholastic standing. A little room for judgment in this direction is a good thing, for often the candidate most expert with paper and pencil may not prove as satisfactory as a more rounded personality with a lower grade.

What are the chances of passing successfully government examinations? An analysis of the entire range of Federal civil service tests given to engineers during the year ended June 30, 1930, throws some light on the subject. Out of the 4,449 applicants who took the assigned tests, 2,126 or 48 per cent passed and were put on the list of eligibles. Never-



theless, in interpreting the number of failures it is well to remember that, since there is no charge for appearing, many individuals without adequate preparation are very apt to "try their luck," for better or for worse. If they fail to pass, they have merely lost time, not money. Of those who did pass the engineering examinations above cited, only a fraction were appointed during the year, a total of 432 or 20 per cent of the eligibles, to be exact.

**Appointment Problems under the Merit System.** Like most human arrangements, even the merit system has its faults. One difficulty is the delay incident to the operation of the plan. As soon as vacancies are likely to occur, notices of the time and place for examinations have to be sent out. Sufficient time must be allowed for "prospects" to make up their minds and formally apply for the right to take the appropriate tests; as much as two or three months may elapse. A period, though limited, is next required in which to grade papers and rank the writers on an ascending scale. Finally, letters informing the several participants of their fate must be dispatched. All in all, six months or more may pass between the appearance of a vacancy and the day when the winner of the post reaches it. If it becomes absolutely necessary to fill positions for a substantial part of this interim, recourse may be had to temporary appointments. In such cases, the appointing officer fills the places until permanent incumbents can be found by the formal process just described. Ordinarily, an engineer cannot apply to the government for employment one day and be installed the next.

To problems of delay must be added those of favoritism. As indicated previously, appointing officers frequently possess the power to select any one of the three persons obtaining the highest test grades. Thus, the two candidates lower in the scale as well as the individual who receives the first ranking may bring influence to bear in winning a coveted post, and there is latitude here for occasional injustice. More

significant is the practice of granting preference to war veterans. Many units of American government stipulate that the sacrifices made by ex-soldiers and sailors entitle them to special consideration in the matter of employment. On this account former soldiers and sailors are frequently given extra points of credit, to add to their regular examination marks, as outright presents. In the Federal administration, as many as ten points out of a hundred may be obtained in this manner. So the civilian must surpass the ex-service man by a substantial margin in order to obtain the position. Clues to the importance of this factor are offered by Federal figures for the engineering examinations held during the year ended June 30, 1930; during that period eighty-nine veterans received sufficient advantages under this arrangement to secure appointments. In other words, twenty-one per cent of the appointees in engineering for the year enjoyed the benefits of veterans' preference.

**Removal of Elective Agents.** Once in power, government employees may lose their positions in a variety of ways. Obviously elective agents, if repudiated at a subsequent polling, are automatically ousted. Nor do they always manage to serve their stipulated terms; in many localities the recall (p. 68) is available as a means of ejecting them at an earlier date. A third process of removal is impeachment. The Federal Constitution and most of the state constitutions sanction the practice. As a general rule, under this system, the lower house of the legislature prefers charges against the official whose removal is sought—"impeaches" him. The upper house then meets to hear the case, sitting as a court. If it finds the accused guilty of grave irregularities, it may proceed at once to vote him out of office. Exactly what constitutes just grounds for impeachment it is hard to say. However, habitual drunkenness, corruption, bribery, and maladministration have been deemed enough to justify the use of the process. Although seldom used, the tool is strong. It was wielded with success to oust Governor William

Sulzer, of New York, in 1913, and Governor John C. Walton, of Oklahoma, in 1923. But at best it is a cumbersome method and, therefore, not an important instrument in maintaining efficient administration.

**Removal of Political Appointees.** "Political" appointees are generally removable at the will of their superiors. Consequently a turnover at the polls, as pointed out in the discussion of the spoils system, may mark the termination of the official life of many underlings. For the purpose of securing the benefits attendant upon a greater degree of permanency, especially where skilled work is to be performed, various restrictions have been placed by legislatures upon summary dismissals in a number of cases. Sometimes the law stipulates that particular officials may not be discharged except "for cause," and thus places a slight barrier in the way of summary dismissal.

**Removal under the Merit System.** Employees holding office under the merit system are generally assured of permanent work, unless they are guilty of gross inefficiency or misconduct. Usually the law specifically states that removal shall take place only "for the good of the service." In case an employee is charged with failure to meet normal standards of his office, he is given a hearing at which he can present his side. If his arguments are unconvincing, he must go. If they are strong, he may be retained. There is justice in this process. To be specific, when the city engineer of Detroit was dropped from his civil service post by a political superior a few years ago, he appealed to the local civil service commission for a review of the action. The commission found that the charges against the engineer were that he was both "inefficient and insubordinate." As for inefficiency, it appeared that he had been held responsible for the construction of a sewer line that had failed. Testimony was presented to show that the line had been built through quicksand, where the difficulties of construction made collapse no grievous reflection on the professional competence of the engineer.



In the matter of insubordination, it was alleged that the engineer had supported the suggestion of a city councilman for an investigation of the failure by an impartial body of experts; while his chief wanted the study to be made by interested department representatives instead. After reviewing the facts in the dispute, the civil service commission finally decided that there was no just excuse for removal and so ordered the full reinstatement of the city engineer to his original rank.

**Compulsory Retirement.** Owing to the high degree of permanency of tenure possible in the government service under the original merit system, many employees continued to work after they were really too old to discharge their duties efficiently. Superiors were generally reluctant to drop loyal subordinates, realizing that such action would cut off the only means of livelihood open to them. In the absence of any profit motive, little incentive existed for discharge in such cases. Ultimately, however, the situation became so serious that something had to be done. So compulsory retirement systems (below, p. 246) were established in numerous units of American government; whether they like it or not, officers reaching a specified age, which varies with the nature of their activities, must leave their posts at once.

**"Ripper" Bills.** Departing sharply from such conventional procedures is the alternative use of so-called "ripper" bills. The process involves the passage of a legislative act abolishing a post occupied by an incumbent who cannot easily be removed by any other method. If it is deemed advisable, a similar position may be created immediately afterward so that a new appointment can be made at once. Although somewhat cumbersome, the method is nevertheless very effective.

## PROBLEMS IN PERSONNEL MANAGEMENT

**Turnover in the Government Service.** A very good index to the general success or failure of any program of personnel

administration is to be found in the rate of turnover. This rate is obtained by dividing the number of resignations and discharges from the service by the average number of employees on the payroll. If men and women are contented at their work, they stay, and the rate is low. If they are discontented, they drop out by the score, with the opposite result. Studies show that in six national bureaus, containing 2,765 persons, the annual turnover of technicians once reached a peak of as much as 69 per cent. During and immediately after the World War, unrest among engineers and scientists in the Federal Bureau of Standards was especially striking, and the turnover rose from twenty-eight per cent in 1916 to 161 per cent in 1919. Such conditions have often prevailed in state and local agencies. But it should be noted that they usually occur in times of prosperity when opportunities for private employment are numerous and larger rewards are offered. Hence, all responsibility for heavy turnover does not rest on officials in charge of personnel management.

**Government Employee Organizations.** Government employees, in quest of ways and means of improving their lot, have organized themselves into associations, after the fashion of industrial workers. Public servants in cities have founded a series of independent policemen's, firemen's, and teachers' "unions." Operating on a larger scale is the National Federation of Federal Employees, affiliated with the American Federation of Labor. Seeking to advance the special interests of their members, these associations advocate such policies as adequate classification of positions, pensions, salaries sufficient to maintain a reasonable standard of living, improved working conditions, and general extension of the merit system. Already they have been able to bring sufficient pressure to bear on legislators to attain many of their objectives. As long as they continue to wield their powers with discretion, constructive benefits are to be derived from their existence. But if they exert themselves in

a purely selfish manner and come into open collision with the government, through recourse to strikes or similar tactics, they may easily paralyze vital machinery of the state, doing great damage to society at large. Their very presence raises the question whether or not some formal means of coöperation should be instituted between government and organizations of its officials with a view to a continuous and sympathetic adjustment of disputes as they may arise. Plans of this type have been tried in some industries with marked success. Although the problems of public service are different, in many respects, exploratory experiments should nevertheless be attempted.

**Political Activities of Government Officers.** Civil service rules themselves act as a brake upon the exertion of undue political influence by such organizations. Federal requirements are fairly typical. They specify that no office-holder under the merit system is under any obligation to contribute to any campaign fund. Nor can he utilize the powers of his office for the purpose of influencing subordinates to support given candidates. While retaining the right to vote as they please and to express privately their opinions on political subjects, civil servants cannot take an active part in party campaigns. Among the proscribed practices in the Federal service are acceptance of the post of delegate to a party convention, the preparation and circulation of petitions having partisan designs, and the publication of periodicals favoring a particular party.

**Classification of Positions.** Organizations of employees, in common with specialists in personnel management, have made concerted drives on certain pronounced defects in the existing administrative system, grossly unequal conditions in the several offices of the same government drawing much of their fire. Often persons discharging substantially the same duties, but operating in separate departments, receive salaries that differ widely. Thus, a "junior examiner" in the Interior Department formerly was paid \$1,490 a year,



as compared with the \$1,744 allowed to employees holding almost identical positions in the Treasury Department. Then, there is the matter of ranking. Even though individuals in different divisions may perform practically identical functions, their official titles may bear little, if any, resemblance. The reverse also holds true—people with like standing may be found engaged in radically divergent types of occupation. Such arrangements, on account of their obvious unfairness, are demoralizing to employees, creating jealousies and fostering unrest. They are also a nuisance to the personnel manager, making it harder for him to shift employees and impossible for him to conduct merit system examinations on a simplified schedule.

Reform lies in the direction of a logical arrangement of all positions, with a view to granting equal titles and equal pay for equal work throughout the entire administrative structure. After a long agitation and many investigations Congress finally provided in 1924 for a classification of Federal employees in Washington on a rational basis. For engineers, per annum salaries were set at the following fixed levels: For all chief engineers, at \$8,000 to \$9,000; head engineers at \$6,500 to \$7,500; principal engineers at \$5,600 to \$6,400; senior engineers at \$4,600 to \$5,200; associate engineers at \$3,200 to \$3,700; assistant engineers at \$2,600 to \$3,100; and junior engineers at \$2,000 to \$2,600. Each rank was in turn provided with intermediate gradations based on periods of service. Roughly speaking, the longer a civil servant remains at a given task the more valuable he becomes, and consequently the larger his salary. As the engineer scale ignores office lines, juniors do not have to worry about coming to a dead-stop in any particular bureau. On the contrary, opportunities for technicians in every branch of the Federal Government are pooled.

**Promotion.** The adoption of a logical and rational system of classification clears the way for an orderly program of advancement. And the latter is a vitally important factor in

maintaining morale in the public service. Knowledge that faithful and efficient discharge of duties will be fairly rewarded by promotion, when vacancies occur, encourages every employee to do his best work. Young men and women are then willing to enter at the bottom, with the expectation of making a career for themselves. Superior posts are filled with experienced individuals, acquainted with and sympathetic towards the work of their subordinates. In short, a genuine esprit de corps is created. Conversely a feeling of helplessness prevails when all the higher positions are assigned to outsiders with little or no interest in public service as a career.

Seeking to take full advantage of experience and loyalty, progressive governments, as explained above, provide for raising the salaries of employees of a given rank in fair proportion to the length of their employment. However, such increments are granted only upon concrete demonstration of greater ability in actual operations. Employees failing to maintain a reasonable level of efficiency may be reduced in pay, to correspond with evidences of incapacity. When a vacancy occurs in a superior rank, an opportunity is presented to subordinates for advancement. The period of service of applicants is taken into account, together with their past records of achievement. Finally, the aspirants for promotion in rank are put through regular examinations, on a strictly merit basis.

After the various factors are weighed, a list of eligibles for promotion is prepared, and one of the individuals at the head of the roll is chosen for the opening. Frequently, all outsiders are excluded from the promotion tests, until such time as a survey fails to reveal the presence of the desired degree of competence within the existing official family. While there is a chance that abler experts may be excluded in this fashion, improvements in government morale may offset the defect. Unfortunately, too many of the better positions are won, not through advancement from below,

but through political appointment from above. Where this is the case, subordinates know that unless they can secure the requisite "pull," they can never rise to the top of the line. Extending the merit system into the higher brackets would bring marked improvements.

**Training Schools.** Private corporations have found it increasingly necessary to establish classes for their technical staffs, as highly specialized knowledge becomes a more and more important part of the equipment of candidates for advancement. And governments have been driven to the same expedient. Most famous of all official schools are the institutions at West Point and Annapolis, preparatory training bases for the Army and Navy respectively. In civil administration there is the four-year program of study for apprentices offered by the Federal Bureau of Engraving and Printing. At the top of the technical scale is advanced training in physics, mathematics, and chemistry, provided by the national Bureau of Standards for its staff. The larger cities maintain schools for firemen, where "rookies" are given a wide range of instruction, including the use of scaling ladders, life-nets, pulmotors, and other equipment, the tactics necessary for successfully combating draughts, excessive heat, and dust hazards, the hydraulic properties of hose, and first-aid to the injured. Police schools train patrolmen in the handling of criminals, the accurate use of pistols and machine guns, the operation of motorcycles, and other technicalities of the craft. Since some lines of public work have few counterparts in private employment—fire fighting, for example—such government institutions are essential to fill gaps left by the ordinary institutions of learning.

**Retirement Systems.** Ultimately employees reach an age when retirement, rather than advancement, is their immediate problem. But, as pointed out above, mandatory removal would be harsh treatment for old and faithful office-holders unless compensatory awards were available. Consequently, the Federal Government, several states,



and many local governments have established pension systems. In Massachusetts, for instance, employees may retire on reaching sixty, while at seventy they must resign. If their total period of service has been fifteen years or more, they receive pensions ranging from \$300 to \$780 per annum as long as they live. Besides making grants to superannuated employees, it is customary to allow those injured in the line of duty to draw a portion of their pay during incapacity. Both age and physical conditions, therefore, are taken into account.

Funds for the payment of pensions may be obtained in any one of three different ways. Sometimes the government itself accepts the entire burden of support. The reverse custom is also found—that of compelling employees to furnish the whole amount. It is urged that the latter arrangement merely requires them to save, just as if they were private citizens looking out for their own future. As a compromise between the two extremes, a sharing plan has been adopted in many cases, whereby political units match employee contributions with public funds—dollar for dollar or better. At present the third scheme seems to be the most popular. As usually administered, it involves deducting appropriate sums each month from pay checks, the average subtraction amounting to about five per cent on salaries in the lower ranges. Where employees themselves are required to contribute, it is customary to permit anyone leaving the service before reaching retirement age to withdraw the amount of his contribution as a parting gift. Not only that; he is allowed a reasonable interest for the term of his deposit.

**The Menace of Corruption.** An outstanding problem in public personnel administration is that of corruption. Instances of malpractice are all too common. When, for example, a New York citizen, a few years ago, discovered that the building permit issued to his company had been revoked at the moment its steel skeleton reached the third floor, he protested at once. At the city offices he was advised that

a certain attorney was "very successful" in rectifying mistakes and should be consulted. After paying the aforementioned attorney \$3,250 for his help, the "mistake" was immediately cleared up and work was resumed. Some time later the president of a bank, to which the builder was indebted, asked if it would not be possible for "a friend" to have an apartment in the new structure at \$1,500 a year, although the normal rental was \$4,500. Curiously enough, "the friend" turned out to be the head of the very municipal board in charge of building permits.

Cases of such tactics could be multiplied indefinitely. Undoubtedly one of the strongest forces operating against corruption is the periodic legislative investigation. But powerful culprits cannot often be caught and punished; many of them are too well trained in the technique of escape. An increase in government salaries in some instances, to overcome the desire for extra "earnings," would probably diminish petty graft. It must be noted, though, that in every case of bribery there is a giver and also a receiver. Where private parties are responsible for taking the initiative, and such unfortunately is often the situation, they bear a share of the blame. It is scarcely too much to say that the standards of honor in public service correspond to the standards of honor in the community.

**Public and Private Employment Compared.** Having considered government personnel problems in detail, we are now in a position to compare the advantages of public employment with those of private life. With respect to security of tenure, the merit system has created a permanency in office that is rarely approached in industry. Civil servants are removable only for cause, and are granted the right of appeal in dubious cases, whereas persons employed by private concerns are subject to arbitrary dismissal. To the average routinier, this feature is of prime importance.

In the matter of salaries, private enterprises have discovered that in the bitter strife of the business world talent

has to be generously, if not lavishly, rewarded. Since taxpayers protest against princely outlays, and since governments are not ordinarily required to show a profit, they habitually pay smaller salaries in the higher ranges than do private companies. A compensation of \$15,000 a year or more is very rare in public service, even for strategic posts, but salaries running from \$50,000 to \$100,000 a year are not unusual for the managing officers of large corporations—a practice now under Federal fire. On the other hand, in the lower grades, government salaries frequently exceed those offered by private enterprise for identical work. Perhaps this feature helps to make up for the smaller number of opportunities for advancement existing in public services. In weighing any salary scale, however, one must take account of possible pension features. The guarantee of a stipulated sum every year after reaching retirement age, or on being injured in line of duty, is a privilege to be placed against higher stipends accompanied by no such privileges.

On account of the advantages possessed by private employment, in certain cases, there is a more or less steady exodus from government to civilian service. For example George B. Cortelyou, stenographer to President Cleveland, private secretary to McKinley and Roosevelt, afterwards Secretary of Commerce and Secretary of the Treasury, subsequently left the public service, later became president of the Consolidated Gas Company of New York, and in the course of time assumed the chairmanship of the Joint Committee of the National Utility Associations. In the former private post he developed vital relations with state and municipal government in New York and in the latter with the Federal Government. His experience and standing proved useful to utility concerns in both connections. Franklin K. Lane, Secretary of the Interior under President Wilson, and his colleague, W. G. McAdoo, Secretary of the Treasury, became counselors to great oil concerns on



leaving their official posts. Similar translations often occur from the lower divisions of the Federal service. A former employee of the Department of Commerce in charge of power matters was made executive director of the National Electric Light Association. After serving the Government for many years, a chief hydrographer of the United States Geological Survey entered private practice as a consulting engineer and soon appeared as an official of a power company. Such movement from public to private employment in America presents a contrast with the tenure of public servants in other countries, who usually remain in the service of their governments throughout their lives.

#### AN ENGINEERING APPRAISAL OF PUBLIC ADMINISTRATION

**Rationality in Administration—a Summary.** Speaking historically, administration in government grew up slowly on the basis of early rule-of-thumb operations quite appropriate to simple agricultural society. In early times it was concerned mainly with tax collection, disbursements, and police. As new functions were added, it grew in complexity and old methods proved to be inadequate. Then efforts were made to reconstruct administration for the purpose of making it accord more closely with the new and intricate duties. In the United States these efforts were connected with the movement in engineering thought known as the development of scientific management. In the early part of the twentieth century when the New York Bureau of Municipal Research began its work for administrative reform, it deliberately made use of the management ideas formulated by Frederick Winslow Taylor and his colleagues in industry. Hence modern conceptions of administration have already taken on some of the form of engineering rationality, and contemporary administration to some extent represents the ideal of engineering rationality. It is proper to present, therefore, by way of summary, in outline form, a picture of an ideal public administration system.

- I. Departmental organization: distribution of activities among a few large departments, each containing closely related activities and headed by a responsible chief, even where boards are employed for quasi-legislative and quasi-judicial functions; all departments tied together by direct lines of responsibility to the chief executive of the municipality, state, or nation and united by cabinet conferences
- II. Intra-departmental organization: distribution of all activities among a few bureaus, each containing closely related activities and headed by a responsible chief; a similar distribution of activities within each bureau among divisions and offices; direct lines of responsibility running from the lowest subdivision through the bureau chiefs to the department head; unification of work by departmental conferences
- III. Personnel system, providing for uniform definitions of classes and subclasses of work, for specification of skills, qualities, and knowledge requisite for each class and subclass of employees—standards to be the same for the same work throughout the entire administrative system, with salaries and wages graded accordingly and with reference to terms of service
- IV. Planning and research staff—based on volume and variety of work—attached to each large division of line administration and charged with continuous planning and research duties, to keep chiefs currently informed about work in progress, administrative performances, and latest devices and operating methods in the field
- V. System of accounting and reporting, designed to indicate accurately work to be done and work done—in mathematical terms where work can be expressed in such terms
- VI. Unification of accounting and reporting for purposes of administrative control and accounting and reporting for budgetary purposes and auditing (below, Chapter VIII)
- VII. Cost accounting, that is, accounting for units of work in terms of actual cost as distinguished from bookkeeping records not based on work actually done but on office entries of charges representing outlays

- VIII. District administration for large geographical areas—coordination of units of different administrative departments or subdivisions in same area for common employment of personnel, use of materials and equipment, purchase and storage of supplies
- IX. Provision for employee organizations—clear channels of communication between chiefs and rank and file for reciprocal exchange of ideas and grievances and for adjustment of controversies
- X. Principles of scientific management applicable throughout:
  - (1) positive advance planning of work, including all activities requisite to accomplishment; (2) distribution of work among bureaus, divisions, and agencies to the last operative in the line; (3) criteria for determining whether each unit of work has been done according to plan and requirement; (4) "Science, not rule of thumb; harmony, not discord; coöperation, not individualism" (Taylor); maximum accomplishment of work; most effective use of powers of each individual with a view to his or her personal development in life; (5) ideal physical conditions of work—light, heat, ventilation, sanitation, safety, security, and peace of mind.

**Administrative Facts and the Ideal of Engineering Rationality.** When the outstanding and relevant facts of public administration in the United States are placed over against the ideal scheme outlined by contemporary management engineering, certain contrasts are striking. Although the survey of public administration presented in this volume is necessarily brief and confined to simplest terms, a number of pertinent facts attract immediate attention. First, while the functions of government have grown rapidly under the pressures of changing needs, still until recently inadequate consideration was given to the coordination and systematic administration of these functions. Second, while these vital functions have been multiplying, the popular attitude toward government service appropriate to the pre-technological age has continued to prevail,



to the harm of the service; despite the indispensable and loyal services rendered by its employees, government has been regarded as more or less of a nuisance that gets in the way of personal rights, liberty, and enjoyment; and public service has encountered more or less indifference, if not aversion, on the part of young men and women choosing careers. Third, educational institutions, with some notable exceptions, have given slight consideration to training for the public service and to the problems of public administration when offering instruction in government, thus making the attainment of high official standards difficult.

Although many students of government and political practitioners have labored ardently and intelligently to build up an efficient system of public administration in the United States, they are still far from their goal. The administration of all except a few states is still based on the political spoils system, despite efforts at "civil service reform." Greater progress has been made in the cities, but even the most advanced still leave many technical posts in the hands of political spoilsmen. In the case of the Federal Government, notwithstanding recent gains, the spoils system prevails in some technical branches of administration where considerations of general party policies are very decidedly inappropriate. Moreover there has been a neglect of personnel administration on the part of high executives in the Federal Government. A few years ago Herman Feldman, after making a detailed survey under the auspices of the Personnel Classification Board, reported the following findings: Few cabinet officers "have exercised any real leadership in promoting a personnel program"; "in the annual messages of the presidents almost nothing can be found to indicate genuine concern for the welfare of the employees"; in the files of memoranda of cabinet officers to subordinates "little is found that shows any vital interest in or broad understanding of the problem of personnel"; a personnel official in the Government has said that, "with one or two exceptions, the

government service seems never to have had anybody in a position of major responsibility who saw the problem of personnel as a whole." Luther Steward, President of the National Federation of Federal Employees, declared in 1931 that, "Until President Hoover issued his executive order only a few weeks ago, creating (or reviving in fact) the Federal Personnel Council, no President of the United States has displayed knowledge of or interest in or even given evidence of being aware of the existence of a personnel problem in the federal service."

Even if these criticisms should be discounted as too severe, the magnitude of the problem of public administration remains unquestioned; and in due course it will doubtless receive the consideration it deserves. Since the functions of government are vital to the existence of American society, since they are increasing rapidly in connection with the industrial and agricultural planning and control measures of 1933 (below, Chapter XVIII), their coördination and administration become major tasks of statesmanship. And inasmuch as so many of these functions involve operations in science and technology, it follows that engineering schools have large responsibilities in this hitherto neglected field of instruction and guidance.

**Engineering Rationality and District Administration.** As scientific management has affected the internal structures and operations of administration, so it has revolutionized conceptions of districts and jurisdictions in their administrative relations. Historically speaking, administration has been built from the ground up: from the settlement and community to the colony, from the colony to the state, and from the state to the Federal Government. This was in keeping with the old agricultural and handicraft economy. In that economy communities were largely self-sufficing. Farms produced mainly for the homestead. Local stores and handicraft shops supplied the community. The functions of keeping order, maintaining roads, guarding health, and

providing education were also communal. Lands and houses in the community supplied most of the revenue for carrying on local government.

In this economy technology made a revolution. Farms became specialized, producing for national and international markets. Handicraft shops disappeared or were transformed into great factories, likewise producing for national and international markets. The maintenance of order was changed, with the appearance of the railroad, automobile, and airplane. Under the new technology all branches of economy were united in a closely meshed web. All industries, farms, and means of communication and transportation were tied to a common purpose, nation-wide in its scope. Unity at the top became imperative to the efficient conduct of any part of the system. Accompanying this unity of economy through technology came the necessity of planning at the top and carrying administration from the top downward to the community. This transformation was well under way before 1929; the crisis accelerated it. The National Recovery Program has recognized it, and functions through downward extensions of administration into communities (Chapter XVIII below); for example, the Federal Government reached down into communities to finance banks, railways, building and loan associations, and to provide relief for the poor and unemployed. Sources of taxation, other than houses and lands, were tapped to sustain the structures of government.

In this reconstruction of administration, technological considerations become dominant in the constitution of administrative districts and jurisdictions. They include such features as the distances over which labor and supervisory forces may be most economically transported, the space range of machinery and equipment (in highway administration, for example), economy in large-scale purchases, the necessity for technically trained officials whose salaries cannot be readily met by communities, and changes in the na-



ture of financing state and local functions. While it is probable that traditional state and local boundaries may be long sustained, for administrative purposes new districts and administrative thrusts will cut through them or ignore them. Ultimately many of them will become obsolete or at all events obsolescent, if technology keeps on the march.

**A Comparison of Judicial and Executive Processes of Law Enforcement.** At the close of this survey of the two processes of law enforcement—judicial and executive—a comparison seems appropriate, for the purposes of the two methods are the same—the attainment of the objectives set by law.

First of all is the striking difference in the efforts devoted in recent years to the reorganization of the two systems and the adaptation of operations to ends. Some attention has been given to judicial reorganization in the light of modern requirements, but it has been relatively slight. While state after state has been reconstructing its administrative system, judicial structures and methods have been allowed to continue almost unaltered, with some slight concessions in the way of specialization (p. 181). The situation in Ohio existing in the autumn of 1933 is thus described by Leon C. Marshall: "At the top is the Supreme Court; below are nine intermediate circuit courts of appeals; then come the common pleas courts—the courts of general jurisdiction—in the eighty-eight counties. As for special and minor courts, there are these: one insolvency court, eighty-eight probate courts, eighty-seven coroners courts, seventy-nine juvenile courts, thirty-five municipal or police courts in as many cities, mayors courts in the remaining fifty-seven cities and in 773 villages, and 2,200 justices courts in the 1,337 townships. In addition there are such agencies as the Public Utilities Commission, the Industrial Commission, the Commissioner of Health, the Superintendent of Education, and the Superintendent of Insurance, not to mention an indefinite number of boards and officers exercising judicial func-

tions with some type of clearance to the eighty-seven common pleas courts. There is, of course, a system of appeals running through this maze; but, aside from the appellate procedure, one may reasonably think of these more than 3,300 courts as separate and distinct with almost an absence of administrative supervision. It is simply incredible that a politics-ridden congeries of courts like this could be expending money economically. What is true of the courts is true of the other agencies concerned with the administration of justice."

When it is remembered that the judges of such courts, especially in the higher ranges, are constantly called upon to deal with complicated questions of fact—technological and economic—and that politics, not rigorous training in these matters, is the controlling consideration in their election or appointment, the contrast with executive processes of administration, at least where the merit system prevails, is certainly striking. And, inasmuch as lawyers form a kind of professional guild, which resists lay inquiry, the chances of reconstruction along lines of administrative rationality are, for the moment, slight. Were the principles of scientific management at work in executive administration also applied to judicial administration, the latter would be subjected to an overhauling akin to that long in progress in the former area of government and law enforcement.

## CHAPTER VIII

### MANAGEMENT OF GOVERNMENT EXPENDITURES

In giving effect to law, governments make enormous outlays for personnel, materials, and services. The purposes for which public money is spent and the sources from which it is derived affect fundamentally both public and private economy. Through the assumption and financing of public functions, governments help to shape the whole course of civilization in the United States and through the forms and incidence of taxation they control, in a considerable measure, the distribution of wealth among the inhabitants of the country. By an undue accumulation of indebtedness, they may burden taxpayers beyond their capacity, sap the strength of economy, and lead to defaults, inflation, and general ruin. The fiscal status of a government reveals its competence to plan, manage, and discharge the functions necessary to keep society going and provide conditions favorable to the efficient conduct of industrial and agricultural economy. It is hardly an exaggeration to say that public financing is the ultimate test of statesmanship.

In all phases of public expenditures engineers are implicated. Among the persons employed by governments, as we have seen, are scientists and engineers of every class and description. In the modern age, technology dominates materials—both the small articles of daily use, such as ink, paper, soap, and mucilage, and great public works such as canals, harbor improvements, water systems, and dams. And the services engaged by government, including transportation and communication, are increasingly technical in character.



## BUDGETS AND ACCOUNTING

**The Need for Budgeting.** Under the American system of government, authorization for spending public money must, as a rule, come from the legislature, sometimes subject to control by the initiative and referendum (p. 69). Legislative bodies control the purse strings of government. Formerly these assemblies voted money for public purposes at pleasure during their sessions, without having any plan in the beginning or consolidating the results at the end. Hence they were besieged by spending officials and private interests, eagerly vying with one another in a scramble for increased or new appropriations. Weighing scores and hundreds of pleas as they came in, legislators granted from day to day whatever sums suited their fancies. If it seemed probable that the treasury would run short of funds before the year was out, new tax measures could be passed hurriedly to meet the deficit. Not until the end of the session, if ever, was it possible to tell whether any sort of balance was being struck between income and outlay.

**Nature of Budgets.** Difficulties arising out of such chaotic legislative procedure led to the devising of budgets. A governmental budget is a detailed statement of estimated receipts and expenditures for a given fiscal period, arranged by major classes and purposes. Increases in or decreases from similar figures for the immediate past are commonly indicated in the document, reasons being given for the change. If the total outgo is expected to exceed the estimated income during the immediate future, suggestions may be made respecting new sources of revenue to cover the difference. In short, the budget is an orderly and comprehensive financial program.

When being planned with statesmanlike consideration for public duties and national economy, the budget of expenditures and revenues, with its hundreds of details touching personnel, materials, and services, calls for the highest

technical competence in defining items and providing for execution. The Federal budget provides for the employment of hundreds of thousands of people representing all the professions, arts, sciences, crafts, and classes of labor, skilled and unskilled; it calls for the purchase of materials, machines, and devices of bewildering number and variety; it calls for services on the part of public and private agencies receiving funds from the treasury. If carelessly made, a budget may induce or permit corruption and waste. If it is properly set up, with appropriate specifications and itemizations, and provision is made for adequate accounting and reporting control, it will work for honesty and precision in the discharge of government functions. Whatever its other merits, the success or failure of a government will finally depend upon its budgetary practices.

Budgets cover at least a single year, as this period includes a full cycle of operations from winter snow removal to summer lawn cutting. As long as twelve months are used as a base, it makes little difference just what date is selected as a starting point. A number of cities have adopted the first of January for convenience, while the national authorities have selected the first of July. Where legislatures meet only once in a biennium, the budget must, of course, be expanded to encompass the longer period. Although it is harder to manage, there is no alternative. Seeking to project schemes of orderly finance into the more distant future, a few localities have tried long-term planning. Detroit, for one, laid out a ten-year program in 1925. As each new budget was prepared, adjustments were made in the schedule for the ensuing decade so that it was always up-to-date, until the crisis of 1929 upset the whole program.

**Preparation of Budget.** Budgets are usually prepared by the administrative branch of the government. The process begins with the dispatch of special blank forms to the several independent departments, boards, bureaus, and establishments. Upon these sheets are entered detailed infor-

mation as to the financial requirements and demands of each unit for the ensuing fiscal period. The returns are then filed with a central budget agency or committee. Here a summary is prepared, giving a picture of the entire array of approximate reports. A critical analysis is made of the whole mass of material. If the survey indicates a serious excess in requested appropriations over prospective revenues, cuts in the former are in order. To accomplish this result, budget officials request the various administrative authorities to reconsider their estimates and prune them down to specified levels. After a struggle, revised proposals are returned to the budget agency which then examines the second collection of figures. Perhaps further slashes are impracticable; if so, suitable tax measures are suggested. Eventually, the process reaches a more or less final stage. Some kind of balance is struck between the two sides of the ledger and a finished document is prepared, constituting the tentative budget for the approaching period. In many jurisdictions the tentative document is next gone over by the chief executive.

When the chief executive has completed his study of the budget, he adds to it a message of his own, and then transmits the whole to the legislative assembly. When President Hoover, for instance, presented his financial plan for 1933-1934 to Congress, he pointed out that strenuous efforts must be made to balance income and outgo. To be specific, he suggested that appropriations for Federal salaries be cut \$55,000,000 below the figure for the previous year. As a further recourse he indicated the desirability of saving \$127,000,000 more by revisions in veterans' relief laws. Since authorized assistance to the states for highway building was drawing near the end of an epoch, he advised against grants for road construction until the condition of the Treasury should improve. Even with these economies effected, President Hoover showed that under present statutes a deficit must result. To avoid this eventuality, he recom-



mended the continuance of the Federal tax on gasoline for another year, in order to bring in approximately \$137,000,000. As a supplementary measure, he proposed that a new tax in the form of a manufacturer's excise levy be placed upon many commodities, to yield \$355,000,000 at a  $2\frac{1}{4}$  per cent level. In terse terms, he summarized the bulky volume of details—a brief statement seized upon by the newspapers and used as the basis for public praise or criticism. Citizens can readily study the budget message but are seldom able to study the budget itself.

**Passage of the Budget.** After the budget is presented to the legislature, the course it follows varies with local practice. Owing to the general importance of this periodical statement, the public in many cities is invited to attend hearings on it, but the amount of popular enthusiasm thus aroused is often disappointingly small. Whether outsiders attend hearings or not, the legislature refers the budget to the proper committee, or in sections to several committees as custom requires. If enlightenment on any phase is desired, the appropriate administrative officer may be asked to appear before a committee and testify. As for final action in the legislature, that depends upon the law and rules. Most legislatures are allowed great freedom, being able to increase, decrease, add, or omit items at will. In fact they may even go so far as to ignore completely all budget recommendations, but budget experts feel that such autonomy is dangerous, as it may nullify earnest attempts at financial planning. Accordingly some legislative bodies are permitted only to decrease appropriations, not to increase them. When the document finally reaches the chief executive, he may exercise his veto power. Sometimes he is permitted to reduce or strike out single items of appropriation. As an alternative he may be forced to accept or reject each appropriation bill as a whole.

**Unbalanced Budgets.** Certain marked difficulties attend the whole process. For one thing, budgets are often left

unbalanced; that is, expenses are allowed to outrun revenues. Such a situation is sure to store up trouble. Of course funds for meeting current deficits may be borrowed, but sooner or later taxpayers must clear off the debt. In case they are unable to meet their obligations at the appointed hour, the credit of the government is badly shaken. Yet during the severe depression subsequent to the year 1929, many state and local bodies took the easiest path. Instead of bending their energies to the rather thankless job of pruning costs in detail and providing new taxes, they let matters slide and evaded their problems by seeking lavish loans; and many of them defaulted on their obligations.

**Items Left Out of Budgets.** Another difficulty is that substantial items are frequently left out of budgets altogether, thus detracting from their usefulness as financial plans. During one year the budget of San Francisco covered but \$35,000,000 out of a total expenditure of \$50,000,000. Bond and county road funds, and items for the operation of such enterprises as the municipal railway were entirely missing. Nor was the document complete on the revenue side, for the sole source of income mentioned was a property tax of \$4,000,000. Similar conditions exist elsewhere; thus the running costs of municipally owned utilities are omitted from the budget in many instances, ostensibly on the ground that such undertakings are self-supporting and need not be considered. As a result, deficits may accumulate before legislators realize that trouble is brewing.

Excessive use of supplementary appropriations is a third factor tending to destroy what might otherwise be a sound financial plan. The process is this. A budget is passed, with numerous important items omitted. Then at a subsequent date a series of deficiency bills is put through, in haphazard fashion, to cover the omissions. But since it is not easy to provide corresponding increases in revenues late in the session, bigger deficits are apt to result from such action. During the year 1923, the city council of Charleston, South

Carolina, authorized emergency outlays amounting in the aggregate to \$128,000 but failed to arrange for a proportionate rise in revenues.

**Example of a Budget.** So much for theoretical procedure. Now let us consider a concrete case. On March 23, 1931, the Federal Bureau of the Budget asked every national agency to send in an estimate of its needs for the fiscal year of 1932-1933. The aggregate of all these demands was \$4,168,759,889.22, exclusive of expenditures to be covered from postal receipts. As the hearings held by the Bureau progressed, administrative officials found themselves unable to justify their requests to the satisfaction of the reviewing agents. And the upshot was that the amount allowed to spending officers was reduced to \$3,942,754,614.22 in the financial plan sent to Congress. Later supplemental items for \$46,625,472.02 were transmitted through the Bureau. By the time Congress had finished with consideration of the document, a total of \$160,247,218 had been added. In short, preliminary proposals were reduced by the budget officers only to be raised in Congress until the final appropriations were almost equal to the original figures.

On the revenue side, results are less certain. Nobody can tell in advance exactly what receipts will be. Consequently approximations in this direction may be far out of line. Thus the Federal Budget Bureau estimated that receipts for the year ending June 30, 1932, would amount to \$4,085,119,927 whereas they were actually \$2,121,228,006.05. The decline was attributed to the unexpected effects of hard times on income taxes, import tariffs, and similar items. Hence it is clear from such experience that a perfect balance sheet on paper may prove to be a very imperfect balance sheet when it comes to actual practice.

**Need for Accounting Control over Expenditures.** After the budget has been adopted, some means must be provided for making sure that it is carried out. Spendthrifts must be held in check, to the end that outlays may be kept within



the bounds of existing appropriations. As a guide in this operation, it is customary to require all spending establishments to draw up schedules indicating just what funds they will require for each month or quarter. At the close of every such period, they must file reports accurately stating how near they have come to meeting their original estimates. Those that continue to run over are cautioned and information on their cases is sent to the chief executive, who must devise ways of administering chastisement. In one state publicity has been tried as a means of punishing lax officers. Charts revealing the accuracy with which agencies were adhering to their financial programs, month by month, were drawn and placed on display where any citizen might examine them.

**Duties of Comptrollers.** But more is at stake than the mere keeping within the allotments of the budget plan. All revenues collected should be expended with accuracy and honesty, and there are grave temptations in handling large quantities of money. Accounting checks on spending officers are therefore necessary. In the earlier and simpler days, examinations of accounts were made by members of legislative committees who would now and then turn the pages of the books as a warning to all concerned that house-cleanings might be expected momentarily. But as governments grew in size and expanded their functions and revenues increased the need for a more orderly and continuous system of control and investigation became imperative. Now permanent officers are appointed by Federal, state, and local bodies to go over registers and ledgers as a regular duty. For practical purposes these officers, who are variously termed auditors or comptrollers, act as watch-dogs over income and outlay.

Auditors and comptrollers have numerous supervisory tasks. Sometimes they are charged with making a periodic survey of governmental finances. Any irregularities occurring in the preceding few months are thereby brought to

light. On the other hand, the examination may be continuous. Under the latter arrangement, the auditor requires executive agencies to report to him on the progress of all tax or revenue collections. Failure to obtain revenues in the proper manner, delay in the operation, or neglect to deposit the same in the authorized places, are detected and remedial steps taken. As for the expenditure side, all requisitions may have to receive the final approval of the auditor or comptroller before being paid. In the exercise of this power he is able to prevent dishonest, inaccurate, and illegal spending of the public's money.

Among the errors to be guarded against is the payment of bills not covered by valid appropriations already authorized by the legislature. As scrutinizer for that assembly, the auditor must give particular attention to this phase of his activities. Many kinds of irregularity may occur. If a concern seeks payment for goods that have never been delivered, a halt must be called in the transaction. Failure to meet specifications for supplies is a just cause for a refusal to sanction settlement in full. In the field of public works, unjustified allowances to contractors in excess of bid prices must be cancelled. Periodically the auditor or comptroller makes reports on finances and his activities to the legislature and the public. In case the legislature wishes to do so, it may appoint a committee to investigate his records. It is even customary, in a few localities, to do this at intervals anyway—just to make doubly sure of what is going on.

**Control of Local Accounts.** Large units of government, such as states, can afford to employ skilled auditing staffs. But there are hundreds of small towns, school districts, and other divisions whose accounts must be managed by lower-salaried persons, of limited experience. These amateurs may have had so little training in financial matters as to make their operations a source of loss and confusion to the community. Yet in the aggregate they control huge sums. Oklahoma, in 1923, contained nearly 6,000 minor authori-

ties, each with distinct power to levy taxes and appropriate money. Altogether they were spending about \$60,000,000 a year, for approximately 96 per cent of all direct taxes collected in the state went to the localities.

Recognizing the importance of establishing adequate checks on local financial operations, about three-fourths of the states have instituted systems of central audit and inspection. Very thorough-going is the Indiana plan whereby officers may at any time go into a city or town and examine its accounts. If gross errors are detected, the matter is brought to the attention of the governor who may take steps to correct abuses through judicial channels. Certainly there can be no objection to the more conservative policy of dispatching men to determine whether or not municipalities are spending subsidies, granted by the state, in the proper manner. Sometimes state agents are even more limited in their privileges, being permitted to make studies of the records only upon the request of a specified percentage of the registered voters in a given area. Thus if a fifth or more of the enfranchised citizens in a community feel that the conduct of their local treasurer will bear watching, they can secure the services of an impartial expert. Nor is all this supervision a mere gesture. It has already unearthed many mistakes. When New York State made a survey of fifty balance sheets in 1916, it found twenty-one of them to be incorrect and a total of \$375,000 was discovered to have been expended in an illegal fashion.

**Example of Auditing Work.** Insight into the importance of auditing control may be gained from a study of routine decisions handed down by auditing agents. As the checking agency for the national Government, the General Accounting Office has denied numerous applications for funds. Thus when the Citizens Military Training Camps section of the War Department tried to get through a voucher to pay for engraving Christmas greeting cards for young recruits, it was rebuked. The Office stated in reply that the item was a



personal and not a governmental matter and hence not chargeable to current resources. Again, an attempt was made to buy and install window shades and awnings out of a Federal appropriation for the construction of two additional stories to a building, but the Office set its foot down at once; it indicated that erection money was not available for supplies.

### SUPPLIES AND CONTRACTS

**The Government as a Major Buyer.** Expenditures for governmental supplies often bring officials into intimate contact with the engineer. The range of items purchased by Federal, state, and local authorities is truly amazing, running from fire-hydrants, dry cells, ink, and electric fans to steam turbines, iron pipe, and lighthouse lenses. Salesmen for manufacturing establishments find outlets here that cannot be ignored. In one transaction a concern sold 456 trucks to the City of New York, while a rival disposed of 774 to the same public authority. Twenty-four police radio broadcasting systems have been installed in an equivalent number of municipalities by a single electrical concern. In a few cases political bodies provide the sole market for specialized equipment. Traffic signals, warships, street flushers, and sweepers are of this type.

**Specifications.** Governments usually buy supplies from private sources on the basis of specifications. A specification is a detailed and explicit statement of the size, shape, nature, and performance of a desired article. Such standards serve three purposes. They prevent the unloading of low-grade goods on official agencies. They offer a definite basis on which concerns may accurately estimate prices. And they provide legal grounds for action so that any company that offers poor quality may be refused compensation for deliveries. Federal purchases are controlled, with few exceptions, by a series of so-called United States Government Master Specifications. State and local units often

use these national requirements, to save the bother and expense of preparing duplicate rules. Where necessary, they place reliance on supplementary private standards or on new regulations of their own contrivance.

United States Government Master Specification No. 58a throws light on the nature of these standards. It covers dry cells, which are divided into several classes, according to composition. H-15-A batteries consist of a horizontal layer of 15 cells, each being of size A, that is  $1\frac{7}{8}$ " high and  $\frac{5}{8}$ " in diameter. Sealing compounds must not flow during 24 hours exposure at 45° Centigrade. Terminals must not only be marked with their polarity, but must be equipped with specified varieties of connections. The overall voltage for the combination shall be at least 22.05 when new. The required life depends upon individual service needs. H-15-A batteries for one grade of work must show a voltage of at least 17 at the end of 150 hours of intermittent draining, through a 5,000 ohm resistance. Even this greatly reduced résumé indicates that when the Federal Government is in the market for batteries both buyer and seller know what kind of merchandise is demanded. Misunderstandings are avoided through adoption of such a scientific basis for settlement.

**Testing Deliveries.** But purchasing specifications are not self-enforcing. If governments are to make sure that deliveries fully meet the stipulated requirements, they must be prepared to check commodities upon their arrival. Consequently national authorities have established a great testing service, under the auspices of the Bureau of Standards, in Washington, D. C. Here all kinds of examinations are made of articles ordered by Federal agencies. State and local bodies, too, sometimes provide official facilities for trying out consignments. Where not properly equipped, they make use of reports from private laboratories. Merchandise failing to correspond to guarantees is rejected, and the manufacturer responsible for the errors is refused pay-

ment until the defects are remedied. Specifications followed by tests, then, assure governments of supplies with fixed standards of excellence.

**Centralized Purchasing.** Fair prices, as well as fixed quality, may be obtained through proper technique. One means of securing a reduction in costs is to take advantage of the fact that wholesale quotations are usually considerably lower than retail figures. If the needs of many branches of a given government for common materials, such as typewriters, ink, and automobile tires, are met through cooperative lump buying, followed by distribution among the agencies in detail, important savings may be realized. Consequently a number of cities and states have established central purchasing offices through which joint requisitions from most of their bureaus are handled. In Washington, D. C., the General Supply Committee long performed this duty for Federal activities located in the city. In June, 1933, however, President Roosevelt, acting under the authority of a recent law of Congress, decreed that the "function of determination of policies and methods of procurement, warehousing, and distribution of property, facilities, structures, improvements, machinery, equipment, stores, and supplies exercised by any agency is transferred to a Procurement Division in the Treasury Department, at the head of which shall be a Director of Procurement."

But the process of centralization has limits. It may be cheaper for widely scattered field units to meet their individual food or gasoline requirements locally than for them to have to order through a single headquarters at the capital. Again, if the entire official demand for a given article comes from a single agency, there is no point in depriving the latter of its buying rights. Since the national Lighthouse Service is the sole Federal bureau in the market for giant rotating lighthouse lenses, it is best to leave the problem of acquisition in its hands. Whether centralized or decentralized purchasing should be employed thus depends



upon circumstances. Each is used. Each has a legitimate sphere.

**Competitive Bidding.** Competitive bidding also helps to keep prices at a minimum. To make sure that all responsible concerns desirous of supplying a given item are afforded equal opportunity to do so, advertisements are printed in current periodicals. These notices describe the variety of article sought, and set a time and place at which quotations will be received and opened. A typical announcement reads as follows: "Sealed proposals will be opened by the Superintendent of Lighthouses, Staten Island, New York, 3 P.M., November 5, 1931, for 300 acetylene cylinders (180 cubic feet capacity when filled) to meet Interstate Commerce Commission specifications for transporting compressed gas. Information upon application." When the appointed hour arrives, the offers are opened in the presence of interested parties, and the results announced. Generally the lowest responsible bidder wins the contract. Rivalry between salesmen seeking identical business is thus taken advantage of to hold governmental expenses at a low level.

**Government Manufacture of Supplies.** A useful check upon the costs of private manufacture may be obtained through the production of supplies, in limited quantities, by governments themselves. For instance, Federal arsenals turn out small amounts of arms and ammunition, obtaining valuable expense data in the process. General Crozier once stated that 45,000 three-inch high explosive shrapnel shells were manufactured for \$456,750 by national plants as compared with a bid of \$592,650 for the same job by a private company. Of course such a system of holding prices at a minimum is severely limited in scope by the general desire of manufacturers and merchants "to keep the government out of business."

**Extent of Public Works Construction.** Expenditures for public-works construction also bring governments into contact with engineers. Altogether the number of men en-

gaged in building operations for Federal, state, and local authorities and the funds set aside for the same are enormous. During the depression beginning with 1929 added impetus was given to public operations by a general desire to stimulate employment through lavish grants from public treasuries. On July 21, 1931, the Acting Chairman of the President's Emergency Committee for Employment reported that in the previous eight months over \$2,000,000,000 worth of public and semi-public construction had been authorized. Numerous items, including water softening and garbage disposal plants, highways, office structures, and harbor improvements were listed. By a special act of Congress, in 1933, the sum of \$3,300,000,000 was appropriated for further stimulating the expansion of public works.

**Contract Specifications.** Ordinarily public works are built by private concerns, operating under government authorizations. The contracting process begins with the preparation of specifications setting forth at length the exact nature of the construction at hand. This stage involves more than routine drudgery; it requires discretion and care. For one thing, lack of skill opens the door for wasteful disputes, as the work progresses. When a construction outfit in New York City began to underpin elevated railway columns with four piles per pier previous to digging a subway, it came into open conflict with municipal agents. The latter claimed that nothing less than six piles per pier was sufficient. As the legal agreement between the two parties threw no clear light on the subject, the matter ultimately went to court, with attendant delay and expense. In other cases judicial channels may be closed by certain provisions of law. Where such barriers exist, government engineers may possess full power to decide finally the issues at stake themselves. It is easy for autocratic abuses to arise in this connection. Consequently specifications should contain adequate detail.

On the other hand, specifications may be made too defi-

nite—for purposes of fraud. After contracts for several million dollars worth of sewers had been let in New York City, a situation of this sort was found to exist. In 1927 rumors began to float about to the effect that clauses had been so written as to prevent the use of any other type of pipe than that manufactured or sold by a certain Lock Joint Pipe Company. While alternative non-patented monolithic construction was permitted in theory, ingenious restrictions had been placed upon its adoption so as to make the cost prohibitive in fact. Accordingly a contractor who had obtained full control over the Lock Joint Pipe process in the Borough of Queens was enabled to market his goods at a tremendous profit in a monopolistic venture. At length taxpayers were aroused and became so angry that a grand jury investigation was started. After prolonged litigation, the city engineer, among others responsible for the work in Queens, was convicted of malpractice, sentenced to a year in jail, and fined besides. Such manipulations of requirements may make competitive bidding competitive in name only. The potentiality for evil bears constant watching.

**Who Is the Lowest Responsible Bidder?** After specifications are ready, notices are printed in periodicals, calling for bids. Usually each offer must be accompanied by a certified check, as evidence of good faith. At the appointed hour the estimates are publicly opened. This phase, then, resembles in some respects procedure in the purchase of supplies. Yet there are marked differences. Awards, admittedly, are made to the lowest responsible bidder in both cases, but the spread among the estimates is apt to be much larger for public works than for supplies. The manufacturer of typewriters knows from experience just about what it will cost him to fill an order. On the other hand, the contractor for a giant dam is not engaged in figuring on an exact duplicate of some previous job. Each such undertaking is distinct and calls for a study of peculiar local conditions. For that reason different minds obtain radically different results.



When bids were received for anchorage and approach spans for the new \$30,000,000 Golden Gate Bridge across San Francisco Harbor, the highest bid was \$2,972,930 or almost twice the minimum figure of \$1,645,841.

Big spreads in bidding render difficult the task of deciding among the contestants. It is not the lowest offer, but the lowest offer made by a capable and reliable concern that should be accepted. And how can the competence of the rivals be determined? The usual practice is to examine the affairs of each company in detail, after the proposals have been opened and listed, and to throw out the offers of doubtful or incompetent concerns. For example, the War Department of the Federal Government called for estimates for the construction of a levee on the Mississippi River in the Vicksburg region. The minimum figure was that of a dredging company, but after looking into the situation the War Department rejected the application of this company, assigning as the reason for its action the fact that the War Department had found by previous experience that the organization lacked sufficient engineering equipment for building the requisite works, in the period of time mentioned in the specifications. Fearing that floods might arrive at an early date, the Government turned to other competitors whose apparatus was deemed adequate.

Two marked disadvantages attend the process of company examination at the close of the bidding. One is that, when the lowest bid is thrown out, the disqualified concern is likely to cause trouble, perhaps by bringing the question of its standing before the courts for settlement and tying up construction in the meantime. Secondly, rejected applicants at the bottom of the list have spent a lot of time and money on the task of estimating costs—to no avail. Cannot part of such lost motion therefore be saved by permitting only recognized contractors to submit proposals in the first place? Exploring possibilities in this direction, a few governments have inaugurated systems of pre-qualification test-

ing. Most comprehensive is an Oregon law which covers all public improvements involving more than \$10,000 to be built for the state or its subdivisions. Prospective bidders on such jobs are required to submit a formal statement prior to participation. In this document they must give full information on their financial status, equipment, and experience. On the basis of the data thus turned in, coupled with any further investigation he cares to make, the officer in charge of the awards may exclude any party. To insure square-dealing, disqualified concerns are given twenty-four hours in which to petition proper state, county, or city boards of appeal for replacement in the final competition. By this method, competent concerns alone have an opportunity to bid and receive awards.

**Inspection during Construction.** As soon as the lowest responsible bidder goes into action, government inspectors should appear on the scene to check construction as it progresses. A part of their duty consists in keeping a sharp eye for attempts to save expense by evasions of the specifications. Just how useful this guardianship may be is strikingly illustrated by a New York example. The City of Yonkers let a contract for steel-work on a new Health Center. Trying to cut down his costs, the erector skimmed on metal. A survey showed that the following vertical members were underweight: 55 out of 70 columns in the lower section, 43 out of 69 in the second section, and 11 out of 63 in the third section. Nor was the condition of cross-beams in the several floors any better. Twenty-eight in the first story were too light, 46 in the second, 33 in the third, 48 in the fourth, and 4 in the fifth. Furthermore in several places a single beam had been used where two were shown on the plans. Riveting was poor, for heads were not concentric with holes, while many were loose and had been burned in heating. Where holes did not coincide, new ones had been cut. Connections, splices, and bearing surfaces were of inferior quality. In the end, these violations of contract

brought just retribution in their train, for the municipality ordered the builder to raze almost the entire skeleton and replace it according to requirements.

A further purpose is served by inspectional activities. Owing to the fact that many public-works enterprises take a year or more to finish, it is customary to pay contractors periodically, as construction proceeds, so that they can meet their current bills. Consequently government agents are required to turn in reports at specified intervals, indicating approximately how much money is due private interests for work completed since the previous check was made.

**Construction by Government Directly.** Governments may construct public works themselves instead of relying on private contractors. Thus the Panama Canal was built directly by Federal authorities. Owing to the magnitude of this enterprise and the hazards of tropical diseases, ordinary concerns could not well be expected to make lump-sum bids of guaranteed accuracy. Extensive dredging operations have also been undertaken by the War Department. It completed in a single year a total of 26 projects at a cost of \$2,195,997 as compared with outside offers of \$3,654,333. Not only was money saved in the process but valuable data on dredging costs were obtained, with which to compare future private estimates on additional jobs.

### SUBSIDIES

**Nature of the Subsidy.** So far we have been dealing with outlays made primarily to keep governments running. In marked contrast to these, are the so-called "subsidies." A subsidy is a bonus or grant made in aid of a private enterprise with a view to helping it overcome adverse economic circumstances that would otherwise prevent or hamper progress. For example, the donation of public lands to American railways enabled them to secure a right-of-way across the unsettled Western plains at a time when they could not



afford to buy the privilege. An imposing array of engineering enterprises, including railways, shipping, and aviation, owe a considerable part of their development to assistance from the government.

**Arguments for Subsidies.** Private enterprises in quest of subsidies strive to convince the government that substantial benefits to the community will spring from proposed public grants. Thus maritime interests made use of the argument that subsidies to American merchant shipping would net large returns to the nation through the employment of capital and labor and the creation of a strong naval auxiliary. Preparedness at sea, they urge, is essential. When America went into the World War, its ocean tonnage was very small. As difficulties abroad severely reduced the number of foreign bottoms available for the transport of American goods, even normal freight could not be cleared from the wharves. To make matters worse, unprecedented quantities of material and thousands of men had to be poured into distant areas of conflict as fast as it was humanly possible. There was no alternative to embarking on a giant program of launching new vessels by extending operations already begun under the Merchant Marine Act of 1916. Extra facilities were speedily provided and hulls were turned out at a velocity which astonished the world. But the total expenditure in the venture was very high—approximately \$3,000,000,000.

Viewing the whole episode with alarm, various groups insisted that the nation should profit by the experience, instead of being caught off guard again. They urged it to operate continuously a great fleet of fast carriers on the high seas, so as to have vessels ready on a moment's notice, in case of emergencies, thereby saving time and money. But economic laws prevented private concerns from building and operating the requisite tonnage in the absence of outside help. Among the adverse factors cited were better wage scales and living conditions provided for American seamen, the competition of foreign merchant fleets supported by

subsidies from their respective governments, and higher fabricating expenses in American yards. It was maintained that if the nation really wanted to be prepared for war, and to have an imposing naval auxiliary at its beck and call, it would have to foot a large share of the bill from the public treasury. After debating the merits of the case, Congress agreed to help finance private lines.

Subsidies may also serve to encourage home industries at the expense of their foreign competitors. Federal aid to shipping, cited above, has had just such an effect. With the help of national subventions, the American merchant fleet rose from eighth in rank among the sea-powers of the earth, in 1912, with 2 per cent of the global tonnage, to second place in 1932, with 12 per cent of the tonnage. What such progress means, in concrete terms, may be gauged by the fact that, in 1932, vessels flying the American flag carried 35 per cent by value of all commodities entering into the foreign commerce of the United States. Inevitably the expansion brings work to shipyards and jobs to American citizens as long as the traffic and the public can bear the burden. On a more limited scale, aid was once given to American beet-sugar industries through the award of bounties. Concerns thus assisted were direct rivals of overseas companies engaged in producing cane sugar; without such grants local works might not have survived. In the end, some factories built as a result of the bonus were able to continue operation after all direct public aid was withdrawn.

**Cash Bonuses.** Turning from questions of policy to ways and means, several types of subsidies are to be found. Sometimes resort is had to frank cash payments. Such was the case with encouragement offered to beet-sugar industries during the last century. The McKinley Tariff Act of 1890 provided that for fourteen years the Federal Government would pay two cents a pound on the entire native product. No strings were attached to the gift. But the promise was short-lived, for long before the expiration of the stipulated

period the law was repealed. Several states adopted a similar course. Nebraska, for one, paid one cent a pound on all beet-sugar, to assist a factory built at Grand Island in 1889. Though repealed shortly afterwards, the statute was revived in 1895 in another form. After 9,000 acres had been planted, the measure was cancelled. Utah, in 1896, voted one cent a pound on sugar to a new factory at Lehi. New York, for ten years, offered between one cent and a half cent a pound on sugar. Michigan, too, paid one cent a pound on sugar in 1897. Altogether in excess of \$30,000,000 was spent in this fashion throughout the country.

Before leaving sugar bounties, mention should be made of the way in which they were supposed to help the ultimate consumer. Prior to the inauguration of the bonus system, a tariff on sugar had been levied by the Federal Government to the tune of some \$55,000,000 a year. In the period from the establishment of the Republic to 1890, a total of \$1,400,000,000 had been collected in duty. This load fell on the consumers. And what was this impost supposed to achieve? It was designed, in part, to protect native beet- and cane-sugar industries. But the domestic production of sugar amounted to only one-seventh of the total national requirement in 1890. So certain Congressmen began to wonder whether it would not be better for the country as a whole to grant a poundage bounty on the small domestic output than to levy a tax on all imported sugar. A cent a pound paid on a seventh of the sugar consumed would be just a seventh as expensive as a cent a pound on the total amount consumed. The bounty, accompanied by a cancellation of the sugar tariff, was supposed to encourage the domestic industry at "the lowest cost" to consumers.

Occasionally a subsidy takes the form of a single grant in a lump sum. Under this head comes the case of Samuel F. B. Morse, the father of the telegraph. After his experiments had convinced him of the feasibility of operating a commercial line of some length, he looked about for ways



and means of financing it. Business channels seemingly being closed, he appealed to the Federal Congress for aid. The session of Congress in which his appeal came up dragged on and on, however, without taking action on his request. On the evening of the final day, Morse went to bed, tired and discouraged with the struggle. But near midnight the legislators suffered a change of heart and passed a bill granting him \$30,000 to assist him in his work, together with an additional sum for maintenance. Out of the gift a successful line was built between Washington and Baltimore.

As a rule, subsidies and bounties have been granted by governments for the purpose of stimulating enterprise, increasing economic activities; but under the Agricultural Adjustment Act of 1933 (below, Chapter XVIII), the Federal Government began to grant money to certain classes of farmers who undertook to reduce their respective acreages under crop. The purpose of this action was to aid in raising the prices of the farm commodities in question by curtailing production. It was a part of the program of economic planning and control introduced by the administration of President Franklin D. Roosevelt. What the results would be was highly problematical, but "relief" had been promised to farmers and one form of it was payment for acreage curtailment.

The payment of cash bounties to private parties has been harshly criticized by lawyers on the ground that it is an unconstitutional use of tax funds—the use of public money for private purposes. There seems to be a great deal of merit in their claim, for certainly one section of the community profits from the other, under the scheme. In fact, on a few occasions, the arrangement has been held by state courts to be unconstitutional. Owing to such complications, and opposition on various grounds, governments are more commonly led to adopt other forms of subsidies, such as the granting of public lands or the payment of excess fees for services rendered. Things that cannot be accomplished

readily by main strength and awkwardness may perhaps be achieved circuitously.

**Grants in Kind.** Among the many devices are grants in kind. Through the acquisition of a virgin continent, Federal and state authorities came into possession of vast domains. Railroad promoters, among others, cast covetous eyes upon these holdings and in response to their urgent pleas, state and national legislatures donated to rail enterprises, between 1850 and 1932, a total of 201,607 square miles—enough to more than equal the entire state of California. The gifts helped in several directions. They provided free rights-of-way. They furnished timber and stone for construction purposes. And, finally, surplus acreage could be sold at handsome figures. The Northern Pacific Railroad alone disposed of its surplus lands for \$136,000,000, thus more than meeting the building cost of the original line—about \$70,000,000. The Illinois Central obtained approximately \$30,000,000 from its land grants—almost enough to cover the expense of completing the route.

Sometimes these grants were planned in such a way as to prevent heavy losses to the treasury. When state and national legislatures donated public land to a private railroad enterprise, they often managed to protect their own interests at the same time. They did this by granting alternate sections of approximately a square mile each on both sides of the track for a specified distance from the center line, while retaining the intervening portions. It was hoped that the construction of the route would result in a rise in the values of the tracts left in official hands, which would be sufficient to offset any loss through alienation to the railway. Frequently the expectation was realized; thus Congress often succeeded in selling Federal holdings near new railroads at \$2.50 an acre, or double the normal price. In this manner significant engineering undertakings were fostered and the Government at Washington derived direct benefits in revenues.

**Excess Payments for Service.** Payments for service, in excess of their true worth on a strictly business basis, constitute a further type of public aid. An outstanding example of this sort may be taken from the Cunard-Collins contest near the middle of the last century. The Cunard Line, an English venture, was winning distinction in the field of steam navigation between the United States and the British Isles. Seeking to bring American ships into competition, the Collins Line asked for generous Federal grants for carrying mails. In 1847 Congress offered \$19,250 per trip to the undertaking. As a result, wooden paddle-wheelers of 3,000 tons burden were put into service, gaining headway against the Cunarders. Ultimately the subsidy was raised to \$33,000 a trip. But a revulsion of feeling, coupled with the loss of two ships, brought a reduction followed by an abolition of the bounty.

After the close of the Collins episode, mail subsidies were granted upon rare occasions. But no general attempt was made to assist the American merchant marine by such favors until 1928. In that year a law was passed under which the United States Government, through the Post Office Department, pays shipping concerns for the carriage of mail in accordance with a sliding scale. Among the factors determining contract price are speed, size of ship, and length of route, the quantity of American mail hauled not entering into the calculations at all. Only American craft running under their own power are eligible. Through this arrangement, liners are assured of a certain steady income, the maximum being \$12 per nautical mile, for every outbound voyage. For the year ended June 30, 1932, the postal authorities estimated that \$20,000,000 more was spent for ocean mail operations than would have been necessary under the old system of payment in proportion to service rendered on a frank poundage basis.

Similar expedients have been tried in the field of aerial transportation. Payments to air mail contractors have, for a



number of years, exceeded the revenue derived by the Federal Government from postage charges. The incentive thus offered to private parties has already been largely responsible for a tremendous expansion in flying, a growth which the industry frankly admits would have been retarded otherwise. Although the "bigger and better" service is still run at a loss, Federal officials believe that efficient maintenance of schedules will ultimately win public support to such an extent as to enable lines to become self-sustaining. Meanwhile other interests look with covetous eye at air and ocean mail fees, and suggest that lighter-than-air craft might be encouraged to make transoceanic runs if grants from the public treasury were forthcoming. All that holds back extensive dirigible development, it is said, is a lack of financial assistance in the formative stages. So the mails carry more than correspondence; they carry a heavy burden of support for private enterprises.

**Free Service Akin to Subsidies.** When governments render significant services to special interests, without levying corresponding charges on the latter, the effect is much the same as though a subsidy had been granted. To illustrate, the Federal Government bought the Cape Cod Canal from its private owners for \$11,500,000. Maintenance costs were approximately \$275,000 for 1930, to say nothing of allowances for amortizing the investment. Yet no tolls were exacted from users of the waterway. A prominent steamship line, that had formerly been compelled to contribute a large amount annually towards the upkeep of the Canal, was thus automatically released from the burden. In such circumstances the national treasury was meeting running expenses that, on a strictly business basis, should have been paid by others. Instances of this sort are abundant.

**Subsidies to Political Units.** Besides aiding private enterprises in various ways, the Federal Government grants outright subsidies to states—for highway construction, the

promotion of education in the industrial and agricultural arts, the maintenance of agricultural experiment stations, public works of several kinds in connection with unemployment relief (below, Chapter XVIII), and other purposes. This is in addition to making loans to local bodies. In turn state governments frequently grant subsidies to cities, counties, and various local units for education, highways, and public purposes of one kind or another. Amounting in effect to a subsidy is the growing practice of states and the Federal Government of taking over and financing functions once left entirely to localities.

The tendency here described has more than financial significance. It means the assumption by superior governments of responsibility for planning and budgeting local expenditures, exercising accounting control, and checking up on technical performances. It relieves local taxpayers and shifts the burden, in part, to the recipients of large incomes and inheritances, and thus affects the distribution of wealth. With the change in financing will come, sooner or later, a drastic transformation in local "self-government," for superior governments cannot turn money over to local authorities to spend at their pleasure without accounting to the grantors for their outlays. In this manner the very structure of government may be profoundly altered without any changes in the letter of the constitutions, state and Federal.

**Loans to Shipping.** Another species of subsidy takes the form of official loans to private engineering enterprises, on terms highly favorable to the latter. In normal times, American governments are usually in a position to borrow money at lower rates than private concerns, a state of affairs for which several factors are responsible. Risks on public securities, for one thing, are often relatively slight, for officials may wield the taxing power with might and main in order to raise funds with which to pay principal and coupons. Furthermore government bonds are wholly or partly exempt



*Courtesy of the United States Bureau of Standards*

### THE GOVERNMENT TESTS ITS SUPPLIES

Tires ready to be given an artificial road test for durability, at the United States Bureau of Standards (see p. 269).





*Photograph by Brown Brothers*

#### GOVERNMENT SUBSIDIES AT WORK

The S.S. *Manhattan*, largest merchant ship ever built in the United States. Over \$7,500,000 was lent by the Federal Government for its construction. The terms were liberal (*see opposite page*).

from taxation. Consequently individuals with extensive investments may receive a greater net return from a public issue paying a low interest rate than from a private issue paying a high rate but subject to taxes. In other words, government bonds can compete in the open market with what seems to be, on the surface, more attractive private paper.

Shipping interests, envious of the low rate paid by the Federal Government, asked for a chance to share it. In response to their pleas, Congress set aside \$250,000,000 to be employed in making loans at low rates for the building of new, or the modernizing of old, vessels. Applicants for money must meet certain stipulated conditions. They must agree to spend the grant in American yards for the most efficient types of construction. After completion, the craft must be operated under American registry and in active competition with foreign lines; otherwise penalties are applied. Provided these terms are satisfactory, a concern may obtain as much as 75 per cent of the value of a given ship or work from the Federal treasury at an interest rate slightly over half as much as private financiers would ask. So shipbuilders become a specially favored class.

Wide use has been made of the privilege. From the inception of the fund to the middle of 1930, requests for help poured in thick and fast. All told, twenty-two steamship companies received assistance to the amount of \$115,000,000. In all, forty-nine vessels were to be constructed and thirteen others modernized from the authorized borrowings. A notable speeding-up of the marine industry became apparent as the fund went into action.

**Loans in Aid of National Recovery.** During the crisis that began in 1929, the Government of the United States undertook to advance money at a low rate of interest to private concerns, government corporations, and local governments, using the Reconstruction Finance Corporation as the lend-

ing agency. This is in addition to grants made under the Public Works Administration (below, Chapter XVIII). The following figures taken from a report of the Finance Corporation late in 1933 indicate the extent and variety of Federal loans and advances to public and private corporations for numerous economic operations:

Secretary of Agriculture for crop loans, \$135,000,000.

Secretary of the Treasury for purchase of Home Loan Bank stock, \$68,545,700.

Secretary of the Treasury for purchase of Home Owners' Loan Corporation stock, \$14,000,000.

Capital of regional agricultural credit corporations, \$44,500,000.

Expenses of regional agricultural credit corporations, \$2,747,874.

Land Bank Commissioner for loans under the emergency farm mortgage act of 1933, \$37,600,000.

Governor of the Farm Credit Administration under the farm credit act of 1933, \$40,500,000.

Direct loans to banks and trust companies, \$1,357,688,506.

Railroads, \$390,271,767.

Mortgage land companies, \$195,259,525.

Direct loans to regional agricultural credit corporations, \$152,224,899.

Building and loan associations, \$112,025,136.

Insurance companies, \$87,292,530.

Federal land banks, \$72,800,000.

Joint stock land banks, \$14,123,505.

Livestock credit corporations, \$12,568,733.

Federal intermediate credit banks, \$9,250,000.

State funds for insurance of public moneys, \$5,887,715.

Agricultural credit corporations, \$5,125,930.

Credit unions, \$574,887.

Processors or distributors for payment of processing tax, \$7,333.

Secretary of Agriculture to purchase cotton, \$3,300,000.

Preferred stock in banks and trust companies, \$55,583,000.

Purchase of capital notes of banks and trust companies, \$25,000,000.



Purchase of debentures of banks and trust companies, \$15,740,000.

Loans secured by preferred stock of banks and trust companies, \$13,528,500.

Advances to states, territories and political subdivisions for relief purposes under the act of 1932, \$299,984,999.

To states for relief purposes under the Federal emergency relief act of 1933, \$272,388,005.

To aid in financing self-liquidating construction projects, \$60,164,882.

To aid in financing the sale of agricultural surpluses in foreign markets, \$4,541,983.

To finance the carrying and orderly marketing of agricultural commodities and livestock produced in the United States, \$4,760,383.

To the Commodity Credit Corporation, \$30,927,594.

**Arguments against Subsidies.** Although subsidies in specific cases may have objectives sufficiently worthy to win popular support, strong arguments are frequently advanced, as a matter of principle, against permitting private enterprise to help itself out of government treasuries. Subventions are designed to cover economic losses with public funds. One section of the community is "taken out of the red" by putting another group of taxpayers "into the red." The weak profit at the expense of the strong. Furthermore financial aid has a tendency to encourage waste. If a concern realizes that it is to have a portion of its deficit made up out of state or national revenues, there is less incentive to good management than in the case of a company that must operate with high efficiency or go bankrupt.

For passing judgment on such contentions or other arguments put forward for and against subsidies of any kind, engineering science has no fixed criteria. It may, certainly, provide specifications and statistical controls for determining whether any particular subsidy or bounty has been properly applied, but this has nothing to do with the merits of the case. If subsidies and bounties were coördinated elements

in a general system of economic planning, their size, results, and relations might be the subjects of engineering calculation. As yet, however, most of them are voted under the pressure of special interests—shipping, industrial, railway, or agricultural—and the question of balance, proportion, and consistency seldom if ever arises.

### RATIONALITY IN BUDGET-MAKING AND EXECUTION

As in the case of both administrative organization and procedure, engineering rationality has entered into the methods of budget-making and accounting control over the execution of authorized operations. This has not been accidental. In leading the movement for budget reform in the United States, the New York Bureau of Municipal Research coupled administration and financing in a close union and applied the principles of scientific management to the both of them (above, p. 227). Since a budget, properly conceived, is a financial plan for projected administrative work, it is evident that the forms and data of the budget must reflect and agree with the forms and data of the administrative work. And the development of budgetary systems through the years tends toward an ideal scheme, the outlines of which are now fairly clear. It seems appropriate, therefore, to supplement description of actual methods by an outline of the ideal financial system in the making.

#### I. Budget documents should include:

1. Estimates of expenditures and revenues for the past and coming fiscal period, classified by departments, bureaus, divisions, and agencies, and showing increases and decreases
2. Estimates from revenue-producing utilities showing operation, maintenance, interest, and amortization charges, with increases or decreases in rates and costs
3. Work programs—showing by statistics and description work to be done under proposed items of appropriation
4. Consolidated statement of expenditures by major items, classified by departments, bureaus, divisions, and agen-

cies; classification within each administrative division according to (a) current outlays for personnel, materials, and services, and (b) capital outlays

5. Consolidated statement of revenues by classes
6. Consolidated debt statement
7. Budget message by chief executive, with recommendations
8. Appropriation bills and revenue bills in exact form for legislative consideration, accompanied by authorization of transfers within divisions

## II. Budget procedure:

1. Preparation of estimates and work programs by departments and agencies
2. Consolidation and review of estimates by chief executive, with aid of budget bureau
3. Hearings on tentative budget
4. Submission of budget documents with message to the legislature
5. Action by legislative committee or committees on appropriation and revenue bills, with public hearings
6. Legislative debate on bills reported from committee by general heads and items, with administrative chiefs enjoying the right to be heard
7. Enactment of bills

## III. Accounting and control should include:

1. Treasury books set up to correspond with revenue and appropriation acts
2. Departmental books set up to correspond with appropriations for respective departments
3. Authorization of expenditure by spending officer, subject to review and approval by comptroller
4. Entry of expenditures against appropriate authorizations in treasury and departmental books
5. Entry of revenues in treasury books against budget authorizations
6. Audit of books at completion of transactions and at end of fiscal period to assure compliance with law
7. Continuous field inspection of work in progress to assure correspondence of operating facts with bookkeeping figures



## IV. Supplies and contracts should include:

1. Classification of equipment and materials
2. Purchasing process
  - a. Specifications
  - b. Directions for manufacture or advertisement for bids
  - c. Letting of contracts to lowest responsible bidder
  - d. Testing of deliveries for compliance with specifications
3. Distribution of purchasing
  - a. Centralization, where geographical propinquity and common use make for efficiency and economy
  - b. Decentralization—departmental and geographical, where justified by special requirements and directness of action
4. Stores
  - a. Centralization of storage
  - b. Distribution of materials as required by agencies, within budget allowances
  - c. Accounting control over receipts and deliveries
5. Contracts
  - a. Specifications for work
  - b. Advertising and letting of contracts to lowest responsible bidder
  - c. Inspection of work in progress to assure compliance with specifications
  - d. Final inspection, approval or rejection

## V. Subsidies and grants to private enterprises should be systematized by:

1. Specification of the objectives, amounts, and conditions of grants
2. Establishment of formal contracts with individuals, corporations, and concerns entitled to grants
3. Creation of an accounting system setting forth the details of all financial transactions
4. Inspection designed to indicate fulfillment or non-fulfillment of obligations by beneficiaries
5. Periodical audit of transactions ended, for the purpose of assuring compliance with law and closing the records of the period.

## CHAPTER IX

### REVENUES, DEBTS, AND CURRENCY

**Cost of Government.** Owing to a rapid multiplication of functions, expenditures for governmental purposes have risen to gigantic proportions. In 1929 they amounted to a total of \$13,048,000,000 or slightly in excess of \$107 per capita per year. Of this sum, 30 per cent represents national, 15 per cent state, and 55 per cent local costs. To raise and administer funds of such size is in itself a herculean task. And the operations of finance are related to the interests of the engineer, for not only are revenues derived from taxes levied on railways, motor vehicles, and other technological instrumentalities, but millions of dollars are borrowed for the construction of public works—highways, flood-control projects, water-supplies, and harbor developments, among others.

#### PUBLIC REVENUES—TAXATION

**Nature of Taxation.** An essential step in any program of public finance is the provision of funds for the support of government. Of all sources of revenue, taxation is the most important, supplying 78 per cent of current income. A tax is a levy made against private persons and property for public purposes. The bill must be periodically paid or dire results will follow. Failure to meet assessments when they finally fall due constitutes sufficient legal ground for official seizure of property. An auction is then held and whatever can be obtained in the course of the sale, over and above existing delinquencies, is turned back to the former owner. If there is no surplus, then the unfortunate delinquent loses everything. Forthright though such confiscation may be,

it is frequently resorted to. To be precise, a member of the State Tax Commission of Minnesota reported in 1931 that in certain Minnesota counties approximately half the land outside of cities and villages had been taken over by the state because of defaulted taxes. Similar conditions prevailed in other parts of the country.

**Purposes of Taxation.** Taxes may be levied for any one of several purposes. Obviously the prime motive is to raise revenue. When the Federal Government was menaced with a deficit in 1932, it was driven to extraordinary steps in an attempt to meet the crisis. The result was a new schedule of levies, affecting the ultimate prices of numerous private engineering supplies and services. An estimate of its probable yield totalled \$342,000,000. From the automotive industry, a huge tribute was demanded: a tax of 1 cent a gallon was put on gasoline, to bring in \$150,000,000 a year; 4 cents a gallon on lubricating oil, \$33,000,000; from 2½ to 4 cents a pound on tires and tubes, \$33,000,000; automobiles, 3 per cent of sales value, \$32,000,000; trucks, 2 per cent of sales value, \$3,000,000; parts and accessories, 2 per cent, \$7,000,000. Tolls, to the tune of \$22,500,000, were to come from communication nets—5 per cent fees on telegrams; 10 per cent on cablegrams and radiograms; and 10, 15, or 20 per cent on telephone messages, according to time and distance. Miscellaneous items closed up the list: various rates on boats, \$500,000; 5 per cent on the value of radio, phonograph, and mechanical refrigerating appliances, \$14,000,000; 4 per cent on oil pipe-line charges, \$8,000,000; and 3 per cent on sales of electrical energy, \$39,000,000. In their quest for money, political bodies dig deep into the resources of engineering enterprises.

But strange though it may seem, taxes are not always designed with a view to raising revenue. Sometimes they are employed, instead, as a means of increasing prices on certain types of goods to a level which will automatically curtail their use. Special interests have thus discovered a



strategic method of destroying their competitors. A clear-cut example of the practice is afforded by the history of the poisonous match industry. Workers in that trade frequently suffered from a slow decomposition of the bony structure of their jaws, due to the corrosive action of certain fumes. Pitiful cases of malformation were the inevitable result. Humanitarian considerations alone were sufficient justification for reform. Unfortunately while non-poisonous matches could be turned out readily, by existing plants, their cost of production was slightly above that of the injurious article. If this differential could only be eliminated, health hazards would quickly disappear but technicians proved unable to invent a simpler and cheaper process. Politics, rather than science, presented the sole avenue of sure relief. After much agitation, therefore, the Federal Government finally solved the riddle by a statute. It placed on poisonous matches a tax of such weight as to destroy their market, turning it over to their less deadly rivals. Forthwith perilous labor conditions in the match industry disappeared.

The "encouragement of manufacturing" is another motive in taxation. Tariffs on machinery, chemicals, and other technical supplies, frequently have a dual objective. They raise the prices of imported commodities, thus substantially helping home industries to meet foreign competition. Naturally a large body of American workingmen are benefited in the process. At the same time, substantial revenues are derived, in many cases, from duties on merchandise entering our ports in spite of such barriers. Whether predominance should be given to protection or to income is a question that admits of legitimate differences of opinion. Hundreds of bitter arguments have taken place in the halls of Congress and elsewhere over this very point. One faction contends that a tariff for revenue only helps domestic consumers by forcing local factories to sell goods at reasonable figures. The opposition maintains that a high degree of self-sufficiency for the nation is to be preferred to low market

values and that a tariff for protection is imperative. Hence the discussion clearly demonstrates the presence of cross-purposes in the field of taxation.

**Taxes in Proportion to Service Rendered.** In levying taxes, an attempt is sometimes made to throw the burden on individuals in proportion to the value of the service rendered them by the government, thus following ordinary business tactics. The effort may be readily illustrated: wear and tear on public roads is closely related to the quantity of fuel burnt by car users. Through the expedient of putting a few cents toll on every gallon of gasoline sold, states are enabled to charge each motorist a fee that is in proportion to the damage done by him to the highways. As long as the sums collected in this fashion are put back into road work, it is said, justice is done.

So-called "special assessments" constitute another important type of tax levied in proportion to service rendered. Experience has taught our public bodies that municipal improvements, such as the installation of water systems, sewers, pavements, and street lighting, as a rule, add value to adjoining land. What could be fairer than the proposition that a certain share of this "unearned" increment be taken away by government to pay for the betterments? The inherent justice of the scheme has a strong appeal; consequently the plan is widely employed by cities and special districts.

Ohio affords an excellent illustration of the method. In 1913 a flood, accompanied by fire, was responsible for a loss of \$70,000,000 to inhabitants of the Miami Valley. Anxious to prevent a repetition of the disaster, they formed the Miami Conservancy District, endowing it with adequate power to build flood-control works in the area subject to overflow. A program of river regulation, involving the expenditure of \$27,800,000, was developed, the necessary funds to be raised by special assessment. Briefly, the plan of taxation was this. Tracts so located as to be liable to the most serious form of

injury were classified in one zone, while those successively less and less exposed to damage were assigned to a series of additional zones. Attention was then given to each section in detail. Thus engineers estimated that the value of property in the most hazardous regions would be thirty per cent greater after the execution of the flood-control projects than previously. Theoretically the owner could in fact turn over the entire increment to the government and still come out even. However there appeared to be no point in an extension of protection that would fail to show a net gain. Actually it was expected that the cost of the necessary construction would represent only thirty-six per cent of the rise in the selling price of the land benefited in the first zone. This percentage, and this alone, constituted the citizen's obligation to his District. Statistically a piece of land worth \$3,333 prior to the completion of the reservoirs would be benefited to the extent of \$1,000 but indebted only \$360. Proportionally smaller levies were made in the more remote zones. Some property owners paid their bills in cash, at once; others fell back on the installment plan with the privilege of clearing off their obligations within thirty years.

**Ease of Collection as a Tax Principle.** Ease of collection affords an additional basis for taxation. Federal authorities have discovered that it is both simple and painless to require internal revenue stamps to be affixed to all packages of tobacco. The sale of the stamps offers a convenient source of revenue. Much the same desire for facility in collection is responsible for the establishment of other indirect levies, as a tax on bank checks or on amusement tickets. In return for their contributions on all these items, of course, consumers are not supposed to receive any direct proportional service.

**Ability to Pay as a Tax Rule.** Taxation, either on the basis of ease of collection or in proportion to the value of the service rendered, is apt to fall with much greater severity on the poor man than on his wealthy neighbor. A millionaire need hardly worry about the few cents per gallon he must



contribute to the state for his gasoline whereas the person of limited means can ill afford even this small sum. In recognition of such conditions, systems of levies founded on ability to pay have been devised. National and state income taxes are of the latter type. Beginning with an exemption for small earnings, rates commonly mount steadily upwards as the higher income brackets are approached. For example, in 1931 Federal surtaxes were only one per cent on salaries ranging from \$10,000 to \$14,000 a year but amounted to twenty per cent on those in excess of \$100,000. During the late war the curve was considerably steeper. Inheritance taxes follow a similar plan.

**Shifting Tax Incidence.** Although a tax may ostensibly fall upon a given group, its ultimate incidence may be quite different. A substantial share of all levies on public utility systems is passed on to the consumer for payment, through adjustments in rates. So, too, taxes exacted from owners of city apartment houses are shifted to tenants. But there are limits to the process, for consumers will sometimes refuse to enter the market in large numbers if an attempt is made to throw upon them the entire load of a rise in taxes. Just such a result is occasionally obtained in connection with imported goods subject to the tariff.

**Taxing Power of the Various Units of Government.** Existing laws provide for a division of the power to tax among the several units of government. Sometimes each has exclusive jurisdiction over certain levies—Federal authorities being alone accorded the privilege of placing tariffs on imported goods. Confusion is easily avoided by such separation. On the other hand, two or more political bodies may have concurrent jurisdiction. In such cases double burdens may appear. Thus we find national agents gathering income taxes in New York at the same time that local officers are collecting income taxes for the state treasury. A similar situation arises on the death of individuals subject to inheritance taxes, when inheritances are split three ways—part

to heirs, creditors, and assigns; part to the United States; and part to the state. Again, heavy burdens spring from the overlapping of special districts. Property located on a spot that lies within the boundaries of five or six districts, each with independent power to fix its own assessments, may be in dire straits indeed. There have been a few extreme cases where the net result is an annual levy in excess of the sales value of the property itself. However reasonable the separate rates may be in themselves, when combined they may become unendurable. The inevitable reaction is a drive for the elimination of such multiple taxation.

**Tax Rates Influence the Location of Industries.** Owing to wide variations in governmental costs, to the cumulative effects of multiple assessments and to other causes, levies in one area may be much above those elsewhere. Business men have to take this factor into account when in quest of an ideal location for new plants. Sometimes the saving in operating expenses incident upon the building of a structure in a city having a low tax rate more than offsets the disadvantages growing out of higher transportation or labor charges there than at alternative sites.

**Tax Exemption.** Relief from any of the burdens of taxation as described naturally proves of substantial assistance to struggling engineering enterprises. Just such encouragement was afforded to a number of early railroads. For one, the Baltimore and Ohio was originally made tax exempt "forever," but later gave up this privilege to gain other advantages. So too the charter awarded to the Richmond, Fredericksburg, and Potomac Railway contained a clause conferring freedom from tax levies. Michigan, in 1891, took steps to foster railroad construction, exempting for ten years all lines built north of the forty-fourth parallel of latitude. While private property, apart from that belonging to religious and charitable institutions, is only occasionally granted tax exemption, government works are generally emancipated from all tax levies. Thus state and municipal

water-works, light plants, and other properties pay no taxes to state or Federal authorities. Whether an undertaking is public or private, liberation from heavy charges inevitably gives it an advantage over less fortunate competitors. The result is lower operating costs and a gain in business. Consequently, when weighing the merits of public ownership in the public-utility field, tax exemption should be taken into account as one of the factors responsible for success.

**Tax Valuations.** Certain types of taxes may be levied without extensive preliminary valuation operations. Obviously a gasoline toll of a few cents a gallon involves nothing more than a measurement of the quantity sold and simple reporting. On the other hand, taxes falling on real property—railroads, electric light plants, or manufacturing establishments—amounting to a definite percentage of the value of the same, cannot be so lightly determined. The usual process begins with the work of assessors who examine each enterprise and determine what they believe to be its worth for taxation. Only rough approximations are possible, owing to the fact that complex factors must be taken into account. For example, even experts are often unable to decide exactly how much depreciation should be charged off for given machinery. Latitude in these respects is illustrated by the case of a Middle-Western water company that took advantage of uncertainties to place its investment for tax purposes at \$585,000 but for utility rate-making purposes at \$1,517,810.

Owing to the difficulty of securing close accuracy, some system for the hearing of complaints against the decisions of assessors must be provided, if justice is to be done. Consequently boards of tax appeals are commonly set up, given power to listen to grievances, and permitted to make such adjustments as they deem necessary. Usually a definite period is allowed after the assessment date during which protests must be filed in order to obtain a review. Final tax bills are sent out to property owners, payable on or before a specified date. Penalties for delay may take the form of a



heavy rate of interest on overdue taxes, increasing in proportion to the lapse of time.

**Tax Levies and Technology.** In early days when land, houses, stock, tools, and other tangible property were the principal objects of taxation, the assessment and collection of property taxes were relatively simple processes. Evasion, either legal or illegal, was difficult. With the complicated developments of technology, however, the situation has profoundly altered. In our own day, technological questions, as well as economic issues, enter into nearly all valuations for assessments, whether for the levy of direct property taxes, income taxes, or indirect customs duties. The few simple objects of olden times have been supplemented by thousands of machines, commodities, and substances of the highest physical and chemical intricacy. Their value is partly, if not entirely, determined by their actual state at the moment of assessment. In innumerable cases only a technical expert can evaluate with any degree of accuracy the exact condition of a particular machine or chemical compound. In the matter of income taxes, where losses from depreciation are deductible from income, only technicians acquainted with particular machines and substances can report the amount of wear and tear or deterioration assignable to the tax year. And where taxes are imposed on a given substance, chemists may devise substitutes which escape the levy.

Owing to this state of affairs, technologists have become deeply enmeshed in the important and difficult issues of taxation. Governments, Federal, state, and local, must employ them in their departments of assessment and collection. Private parties employ them in making out returns and combating the rulings of tax authorities. Hence the recent history of taxation and tax evasion contains interesting chapters on technology. Illustrations are easy to find. Several years ago, after Congress had imposed a tax on artificially-colored oleomargarine that heavily burdened the industry, a chemist produced a yellow ingredient of high

nutritive value which made the resulting butter substitute no longer "artificially colored." The net saving was  $9\frac{3}{4}$  cents per pound in taxation. The advantage did not last long, however, for Congress soon changed the wording of the tax law in such a way as to cover the new substitute.

In the field of income taxation, where huge corporations are taxed on gains and profits by the year, technologists hold the key to the situation. The amount which a large concern can "write off" under the head of depreciation, deterioration, and obsolescence may be tremendous, and the interpretation of the facts turns upon technology. Now the various governments employ experts in this field—at salaries which are almost trivial as compared with those which corporations can and do pay. Naturally government agents are constantly passing from employment in the financial department to private service, thus putting their special knowledge of taxation as well as technology at the command of companies engaged in protesting against income-tax rulings or in obtaining "refunds" of taxes already paid. However recruited, experts in taxation and technology in the service of corporations have been continuously active in securing reductions in levies and refunds in payments previously made. During the administration of the Treasury Department under Secretary Andrew D. Mellon, tax refunds on various grounds were so extensive as to lead to a congressional investigation and acrimonious debates in Congress. In the course of the controversies, the various technological aspects of tax assessment were developed at length, and made the subject of inquiry and exposition. Enough information is now available to provide substance for an entire volume on "Technology and Taxation."

#### REVENUES OTHER THAN FROM TAXATION

**Income from Business Enterprises.** Apart from taxation, there are a number of secondary varieties of revenue. Most important among the latter is the annual income derived

from government ownership and operation of miscellaneous business enterprises—such as water-works, electric and gas plants, harbor facilities, and street-car or bus lines. During 1927 combined returns from these undertakings, in cities of over 30,000 population, amounted to \$291,000,000. Substantial sums are also secured by smaller municipalities, the states, and the national Government. The Panama Canal and the Post Office bring in millions of dollars annually.

Sometimes the revenue derived from public-works operations considerably exceeds the expenses of the enterprises in question. Substantial surpluses may thus be accumulated for ultimate diversion into other channels of expenditure. Through such shifts, the burden of general taxation may be substantially lightened. Quite remarkable in this connection is the case of Colby, Kansas, where the net income from the municipal water plant was employed to meet all the costs of administering local government, provide \$200,000 worth of pavements, and put a noteworthy balance in the city treasury besides—in the course of a brief period. Similarly the Pasadena, California, municipal light and power system has been employed as a tax-relief medium. It has advanced \$125,000 to the city for the building of a municipal golf course, \$600,000 for the construction of a civic auditorium, and \$120,000 for a hall of justice.

Many "average citizens" seemingly find it somewhat more pleasant to support the administration through excessive water or electric rates than by paying taxes. The process resembles painless dentistry. But appearances may be deceptive, since the former method may actually be much worse for them than the latter. That is, if revenue is derived through taxation, the owner of a valuable estate naturally is called upon to foot a bigger bill than the possessor of a modest dwelling on a low-grade lot. But if public revenues are derived, instead, from sales of water or electricity, a very different situation arises. The burden on the wealthy man will be relatively light while that on the poor man will



be out of proportion to his capacity to pay. In weighing the advisability of resorting to one form of revenue-raising or the other, therefore, due consideration should be given to the incidence of the burdens.

Of course a government may own but not operate an enterprise. Instead of managing a piece of property itself, a political body may lease the same to private individuals for exploitation. Substantial revenues are derived from royalties on coal, oil, gas, or other mineral lands rented out by national authorities. Long Beach, California, also obtains large sums from her rentals, as much as \$2,000,000 being collected in a single year.

**Grants of Money by One Government to Another.** A further important class of revenues consists of funds supplied to one political unit by another. In the nation-wide drive for good roads this type of aid has occupied a prominent position. Each year, recently, Federal authorities have appropriated in the neighborhood of \$75,000,000 for distribution among the states, to relieve them of a part of the cost of building arterial thoroughfares. In the same manner states may offer assistance to smaller bodies—Massachusetts, for one, having granted \$2,500,000 in a single year to cities and towns for local highway maintenance and construction. Examples of the same practice exist outside the engineering field, among them being large sums allotted to cities and towns for the support of the public school system. During the administration of President Franklin D. Roosevelt, extraordinary sums were turned over by the Federal Government to the states for unemployment relief.

Intergovernmental grants may be effectively employed as a means of helping the weak. Federal aid for highways illustrates the process. A third of all national allotments for road work is distributed among the states on the basis of their respective areas. Western sections, large in size but short of funds, are thereby benefited at the expense of small Eastern districts in which wealth is concentrated in close

quarters. On a different footing is the apportionment of another third among the states in accordance with their respective populations. States with a high per capita income may thus be forced to share it with those having a very low per capita income. Through proper allocation arrangements, all kinds of adjustments may be made to secure whatever equalization of opportunity or burden is desired.

**Excess Condemnation.** Occasionally taxation in the form of direct or special assessments is avoided through a business arrangement known as excess condemnation. According to this scheme, a city may take more ground for a given public improvement than is necessary for the building of proposed new structures and after the construction is done, the city may sell or lease the surplus area at a new and higher valuation. Following its program of widening Belmont Street, the City of Worcester, Massachusetts, disposed of the extra land condemned by it at a figure said to be three times the amount originally paid for the property. But the method is likely to arouse strong adverse criticism from property owners, hindering attempts to employ it on any extensive scale.

**Gifts.** Miscellaneous sources of income are numerous. Among them are occasional gifts. Probably the most outstanding instance of such philanthropy is the donation by Andrew Carnegie of millions of dollars for the erection of public libraries, scattered throughout the nation. On a considerable scale, land for public parks has been obtained from generous citizens, free of cost. In the engineering field, we have the case of J. P. Morgan who presented his yacht, *Corsair II*, to the Federal Government for the use of the Coast and Geodetic Survey. The latter agency has since renamed it the *Oceanographer* and is employing it for hydrographic explorations in the Atlantic. By obviating the necessity of building a boat of that style for the purpose, the Government estimates that \$500,000 has been saved.

**Fines, Penalties, and Forfeitures.** Fines, penalties, and forfeitures must also be reckoned among current govern-

mental revenues. During 1927 the income from these sources in American cities of over 30,000 population ran up to a total of \$18,700,000. Typical of the class as a whole was \$3,675 collected by Federal aviation authorities in the year ended June 30, 1930, for violations of air law, such as unreasonable "stunting."

### PUBLIC DEBTS

**Revenue from Borrowings—Bonded Debt.** Current revenues are frequently insufficient to meet the immediate cost of building extensive public works and to cover other outlays. Such being the case, resort is often had to borrowing until the time when the completed enterprise can earn enough money to clear off the loans or tax revenues can be augmented. The importance of the process is indicated by the fact that at the close of the fiscal year 1929 the bonded debt of state and local governments was \$13,500,000,000—a huge sum, though considerably less than the total outstanding Federal obligations.

**Debt Limits.** Naturally the first step in financing a public work with borrowed money is to estimate the sum needed to complete the enterprise in question. Then this total must be examined in the light of existing local restrictions. Where there are no checks on potential extravagance, as experience demonstrates, governments tend to run wild, floating loans of such magnitude as to threaten, if not overwhelm, the community with "bankruptcy." By way of reform, one state after another has established fixed debt limits; but the Federal Government has none. Usually such provisions specify that the outstanding debt obligations of a given political body shall not exceed a certain percentage of the value of property subject to taxation within its jurisdiction. If prior borrowings have already brought the debt up to this level, then the proposed undertaking must be discarded at once. There is, however, a tendency to make exceptions in the case of revenue-producing public works. Often money



can be lawfully secured by borrowing, even in excess of the debt limit, if the same is employed for building electric, water, or other plants, the net revenue from which covers all principal and interest charges.

**Popular Approval of Bond Issues.** A second stumbling block in the way of easy borrowing may be the necessity for popular approval of proposed bond issues. As pointed out in another connection (p. 71) elections are held in many jurisdictions to pass upon any heavy borrowing, with a view to protecting the taxpayer against excessive burdens. Theoretically the latter will look out for his own interest by rejecting all extravagant projects. Actually he may be duped. By underestimating the cost of a given enterprise, he may be led to sanction an initial issue of bonds. Then, when this original authorization is exhausted and the undertaking is still only partially completed, a new series is brought before him for action at the polls. In other words, he is asked to choose between letting a semi-finished, and therefore useless, plant stand idle and winding up the work so that the plant can earn revenue by rendering services. The voter is more than likely to follow the second course. Sometimes the process continues, through a number of supplementary pollings, until the work is ultimately finished at considerably more than the original figure.

**Sale of Bonds.** If a proposed loan survives the hazards of debt limits and popular approval, the necessary bonds are prepared. A call is made for bids to be turned in on an appropriate date and at a specified place. Usually one or more large banking concerns will make tenders for the entire issue. Sometimes they offer to subscribe for the securities at a figure considerably above par, the resulting premium then being available towards the payment of interest or the redemption of principal. On the other hand, the competing financiers may feel that the interest rate is too low or the security insufficient, so that sales may be made only below par. Owing to the fact that a governmental body cannot be

exactly sure in advance just how much money it can obtain from the sale of bonds of a given face value, it is not a simple thing to determine the exact size of a proposed offering. An approximation is all that can be achieved.

**Redemption of Bonds.** The highest responsible bidder gets the issue, which he proceeds to retail to the general public. These bonds constitute a promise to return the principal of the loan at the end of a specified period, and to pay annual interest at a fixed percentage during the interval. In order that the necessary money may always be available at the precise moment when regular principal payments fall due, it is frequently the custom to establish a "sinking fund." Into this fund is placed at stated times a sufficient proportion of current revenues derived from taxation or from the operation of the completed enterprise to discharge or amortize the principal when it falls due. If there are any lapses in payments from earnings, and the terms under which the securities were sold so require, provisions may be made for the meeting of defaults out of general taxation. Just such a proviso is to be found in connection with certain water-supply debts of the City of Los Angeles. Even with all these safeguards against failure, it has happened on more than one occasion that government bonds have gone into default. The most famous repudiation is that of a few Southern states which have long refused to redeem certain paper held by American and foreign citizens. Instruments put out by mining or lumbering towns ruined by the exhaustion of local resources have become worthless.

Maturity dates for bonds are preferably set with close reference to the rate at which the material or equipment covered by the issue will depreciate. For two reasons, it is highly desirable that the term of a bond should not exceed the life of the object which it covers. If this rule is violated in the case of bonds secured by revenues on public improvements, a time may come when the holder of a bond possesses a mortgage on property that has ceased to exist or has be-

come practically worthless; unless provision has been made for recourse to other revenues, the security for his bond has vanished.

Where the burden falls on the taxpayers, they are in the unhappy position of having to pay for an "improvement" from which they derive no benefit. The generation that should have cleared off the debt has unloaded on them a burden from which they receive no compensating advantage. A case in point is that of a city which went so far as to sell fifty-year notes in order to purchase a quantity of second-hand fire hose, a commodity that could not possibly hold together for a full half century. But ideals are not always good guides, for extraordinary circumstances may make their application impossible. When the severe depression beginning in 1929 created a need for unemployment relief, a number of governments were unable to carry the expense out of normal revenues. Recourse was therefore had to bond issues in many instances. It was hoped that after the return of prosperity the debt could be comfortably discharged, but naturally there was no perfect clue for discovering when the "corner would be turned."

**Types of Bonds.** Two primary classes of government securities are to be found on the market. Term bonds are distinguished by the fact that the entire issue is to be repaid on a single specified date. Callable term bonds represent a variation on the above. Although otherwise normally maturing after the fashion of regular term bonds, callable bonds may be drawn in whole or in part for payment prior to the end of the period. Thus a city may obtain a water-works loan with the understanding that the entire borrowing must be cleared up at the end of forty years but that whatever sums the authorities may wish to employ in the interim may be used to retire bonds at any interest date after the expiration of a certain period. Such an arrangement gives a political body a chance to take advantage of favorable financial turns to extinguish debts, but does not compel action if times are hard.



A second variety consists of so-called serial bonds. These are securities issued with the express understanding that definite blocs of them are to fall due at given dates. For example, a loan of \$100,000 may be floated, with the proviso that \$10,000 is to be retired per year for ten years. Frequently, in the case of public works, no redemption is attempted for the first few years, during which construction will be in progress and no revenues or other benefits will accrue from the enterprise. Then, as income begins to arrive, the undertaking is allowed to amortize its debt in installments. An ingenious way of handling the situation is to arrange for such odd amounts of principal to fall due each year as to make total principal and interest charges approximately constant year after year. For example, suppose \$1,000,000 is borrowed at five per cent for five years. If \$181,000 matures at the close of the first year, \$190,000 at the close of the second, \$199,500 in the third, \$209,500 in the fourth, and \$220,000 at the end of the last, the sum total of principal and interest charges payable annually will run very near to \$231,000. Serial annuity is the name applied to such bonds.

**Short-Term Notes.** Funds may be secured for public purposes through the issuance of short-term notes. Emergencies, such as those arising from fire, epidemics, or difficulties due to illegal practices in the preparation of assessment rolls, have been met by this means. Recourse may also be had to the same expedient in anticipation of taxes, for it so happens that fiscal years often begin in advance of the date on which taxes are due. Of course the gap might conceivably be spanned through the use of surpluses inherited from the previous twelve months but treasuries are seldom full to overflowing. Where no alternative is available, warrants are sold to pay running expenses until regular revenues can be collected; then the paper is redeemed. As long as the process is well safeguarded, no harm need result. However it is possible to issue securities against future receipts that

will fail to materialize. Perhaps the estimated income was set at an unreasonably high figure or defaults on tax bills exceeded expectations. If such misjudgments continue year after year a debt of dangerous proportions may accumulate. Consequently the law occasionally provides that each temporary loan shall be cleared up within the next fiscal year after it is floated. Still another objective in short-term borrowing may be to permit periodic reimbursements of contractors for their labors on public works. After an enterprise is completed, the temporary debt may be taken up by the substitution of long-term bonds. An advantage in the procedure arises from the fact that when the bonds are ready for sale the cost of the undertaking is accurately known.

### THE CURRENCY SYSTEM

Closely connected with public finance, both theoretically and practically, is the provision of currency as a medium of exchange in economic transactions. For centuries it has been recognized that this is a proper function of government and the discharge of the function is related to public debts, revenues, expenditures, and obligations. For example, notes issued by governments for the payment of bills or made receivable for taxes are often mingled in the common stream of money employed in commercial operations. And now the currency is becoming intimately involved in the move for price stabilization and the stimulation of industry under the New Deal.

**Barter versus Money.** The exchange of commodities in the distant past began with barter, and history records its course. Under a system of barter, payments are made for commodities in kind rather than in cash. When an American Indian with a supply of skins, by way of illustration, wanted to secure a rifle, he was accustomed to give his furs to some wandering white adventurer in return for the weapon. But the method is awkward since it may be hard or out of the question to find an individual who is prepared to make the

desired trade. On the other hand, if something of common utility, such as an ounce of precious metal, is set up as a standard of value, then the search for a prospect is simpler. Money, or its equivalent, has therefore become the general medium of exchange for business transactions throughout the civilized world.

**Federal Control of Money.** In the United States, the Federal Government now exercises exclusive control over the currency. The Constitution vested in the Federal Government the sole right to coin money and regulate the value thereof and for some time it was assumed that Congress possessed a similar monopoly over the issue of paper money. But under a curious decision of the Supreme Court, the states, although forbidden to emit bills of credit, were allowed to charter banks and to authorize them to perform the operation. However this loophole was soon closed. After the country had been flooded with worthless state bank issues, the practice was abruptly ended by the imposition of a prohibitively high national tax on such emissions by state banks. By circuitous means, when organic law did not suffice, Federal authorities have obtained complete domination over the currency system of the country.

**Types of American Money.** American money was, theoretically, based on a standard dollar which, by congressional definition, contained 23.22 grains of pure gold, but the President, under an act passed by Congress in 1934, may fix the amount at a level between fifty and sixty per cent of this figure. For fractional currency, alloys of cheaper minerals are employed. Silver forms the major component of dollars, halves, quarters, and dimes. Nickel is the principal constituent of the five-cent piece and copper of the penny. All these subsidiary coins are technically known as tokens. A token is a piece of money the face value of which is considerably in excess of the worth of the elements it contains. Distinct from the system of metallic money is the paper currency, issued in denominations ranging from a dollar to



several hundred dollars. Certain of the issues are emitted by the Federal Government; others by banks chartered under Federal auspices. In theory, bills and tokens were, for a long time, both exchangeable, at any moment, for gold; that is, they were warehouse receipts for that precious substance, gold, at the national treasury. In fact, under legislation passed by Congress in 1933, the payment of notes and obligations in gold is now forbidden. The country is "off the gold standard" (below, p. 318).

**Paper Currency Inflation.** Serious situations may arise as a result of the use of the various forms of money just described. Chief among these are the problems springing from the inflation of paper currency. History reveals that bills may be issued to a face value greatly exceeding the gold available as a backing before citizens become alarmed enough to want to exchange the paper for the gold. Taking advantage of this possibility, hard-pressed governments sometimes seek to pay their debts by quietly issuing paper notes or bills to cover their obligations. As it costs only a few cents to print thousands of dollars in large denominations, deficits can be easily met—for the moment. However the prodigious capacity of modern high-speed presses may tempt officials to overreach themselves. Having successfully floated one series of paper, they may try another and yet another. At length, citizens become alarmed and the movement to redeem paper in gold grows to unmanageable proportions. Soon the entire metallic reserve may be gone unless the government calls a halt by refusing to continue paying it out. In either case, the paper loses a substantial part of its face value at once. Consequently the government has to print more paper than it formerly did to meet given obligations. New outputs bring a further decline in the purchasing power of the notes. And so the cycle is repeated until the paper becomes almost worthless.

Illuminating examples of this very phenomenon may be taken from European history in connection with the World

War and its aftermath. In Germany more and more currency was poured from presses to pay for men and supplies. Gold backing was eliminated. Then the face value of the mark was based on nothing but "the credit of the government," or thin air, and fell precipitously as one issue of paper money after another made its appearance. Extraordinary developments followed. A letter that could once have been mailed for a fraction of a mark now required hundreds and then thousands of marks in postage. Debtors cleared off heavy mortgages on their property in depreciated paper, worth but a few marks in metal. A basket full of old notes was needed to buy a single suit of clothes. Employees were sometimes paid in bills so new that the ink came off on their hands. Corresponding conditions were to be found, on varying scales, in several other European countries. While no such serious inflation has been experienced in the United States in recent times, the danger is always lurking around the corner. At present, Federal statutes seem to guarantee a certain backing of precious metal for the monetary system. But giant printing machines stand ready to destroy this stability almost overnight, at the command of politicians loath to profit from the experience of other lands. By an act of 1933 the President is authorized to issue \$4,500,000,000 in pure paper.

**Gold Not a Stable Base.** Although precious metals constitute a much more stable medium of exchange than paper, even they can fluctuate in value. Since the United States dollar is defined as so many grains of gold, variation in the market price of gold affects the basis of the whole currency system. If the gold supply exceeds demand by a large amount, the dollar sinks in purchasing power. To be very extreme, if gold miraculously became as common as iron, then the gold dollar would be suitable grist for penny slot machines. On the other hand, if the supply of gold falls far below the demand, the dollar soars in value. So gold dollars are unbalanced dollars; they depend for their status upon the

condition of the mineral market. And as we shall soon see, that market is in turn dependent partly upon progress in chemistry, metallurgy, and exploration.

**Fluctuations in Gold Supply.** Turning to the matter of supply, we may dismiss without further comment present achievements in the transmutation of baser metals into gold, as being still far too costly to be of commercial interest. That leaves to the mining engineer the problem of increasing the gold stock. Somehow he must locate and remove ores in a steady stream if current requirements are to be met. Nor is the task an easy one. Simple alluvial deposits are almost gone, leaving various complex veins to be explored with difficulty. For example, one of the world's prime gold fields is that of the Rand in South Africa. At Johannesburg there exists a lode running at a steep incline into the earth. Here the Village Deep mine is in operation. Already shafts are down 7,600 feet beneath the surface, following the beds as best they can. Owing to the depth, temperatures in the mines mount to 97° F. In order that life could be properly sustained, a refrigerating system had to be installed for pumping cool air to the workers. Nevertheless the heat and humidity result in cases of apoplexy. How long the needs of the world for gold can be satisfied, therefore, depends upon man's cleverness in overcoming growing obstacles to the extraction of the ore.

After the ores have been brought to the surface, the task of separating gold from the other ingredients may be hard to handle. As the higher grade lodes were exhausted, developments in metallurgical technique caused profound fluctuations in supply. Writing in 1907, MacIndoe remarked: "If we consider the greatest gold-producing regions . . . we shall see that in no case would profitable working have been possible thirty years ago; . . . the most important recent factor affecting the production of gold was the Cassel Company's patent for cyanide. . . . No less than thirty-three per cent of the South African production is recovered by



cyanide. I have examined the annual reports of a large number of the principal African mines, and desire now to express the opinion that without cyanide scarcely one South African mine could live. . . . The cost of gold produced from the battery alone is exceedingly high. The cost of the additional gold produced by cyanide is exceedingly low. The two combined enable the mines to make profits. South Africa lives by cyanide." At all events, world outputs of gold rose from 5,000,000 fine ounces a year just prior to the advent of the cyaniding process to almost 23,000,000 fine ounces annually in the ensuing couple of decades.

In short, gold output is dependent upon the skill and ingenuity of the engineer in surmounting one obstacle after another. Whether or not he can keep pace with future demands for an increase in gold reserves as a basis for paper currency expansion, time alone will reveal. The responsibility is a heavy one.

**Demand for Gold in Industry.** As pointed out before, the current value of gold largely depends upon both supply and demand. Having examined the influence of technology on supply, it remains to be seen what effect it has on demand. Gold is sold for two prime purposes—monetary reserves and commerce. Estimates of the industrial consumption of the element are rough approximations but apparently between forty and sixty per cent of the output goes into this channel. Among the many scattered uses may be mentioned the following: for teeth and fillings in dentistry; as leaf in lettering books, gilding, and signs; in compounds for special photographic work; in compounds as a medicine, gold bromide being used for epilepsy; in pen points; as dust for decoration; as wire for fancy braid; and for many kinds of jewelry. New requirements for the rare metal in industry, by creating additional buyers, tend to raise the cost of bullion to the government. Obviously, then, technical progress makes for instability in the gold standard from start to finish.

**Fluctuations in Silver Supply.** Silver is the only rare metal that has been officially adopted by foreign countries as a monetary standard in preference to gold. But like gold, silver is an unstable currency base, varying in value with fluctuations in the balance between supply and demand. Turning to extraction first, we again find metallurgical developments playing havoc with the output curve; for example, the introduction of dynamite caused a phenomenal increase in production after 1873. Once more quoting from MacIndoe: "The silver mines, or rather silver quarries all over the world are peculiarly suitable for the use of dynamite. From cost sheets which I have seen, I am satisfied that the use of dynamite, instead of gunpowder, for blasting, reduced the costs of many silver mines by fifty per cent. The invention of dynamite was, in my opinion, the principal cause of the drop in [the price of] silver from 1873 onwards." Since silver is associated with lead and copper in ores, the separation of all three constitutes a single chemical problem.

**Demand for Silver in Industry.** On the demand side, we find silver flowing into the dual channels of industry and government bullion. However it is estimated that less than twenty-five per cent of the output is consumed in the arts. Consequently everyday commercial and industrial purchases have a relatively small effect in fixing market prices for the metal. Among the commercial requirements are the following: in photography, silver compounds form the basis for films, plates, printing paper, and photo-engraving; in mirror manufacturing, silver serves as a reflecting surface; it is employed as a surfacing substance for table-ware and other objects too numerous to mention; it is of value for switch points; as an amalgam, it is a major dental material; and as a solder, it is found to be resistant to high temperatures, corrosion, and vibration, making it suitable for airplane motors, refrigerators and other machines.

**Technical Difficulties with Bimetallism.** Gold being comparatively rare while silver is relatively plentiful, a number

of nations have experimented with bimetallism. This system involves fixing a ratio between the quantity of silver and quantity of gold in the official standard of value. A reserve of both metals is kept, and paper or tokens may be exchanged for either. Thus the United States, in 1792, declared that the dollar must contain a specific amount of gold or fifteen times as much silver by weight.

But when a government simply announces that a fixed weight of silver is worth as much as a fixed weight of gold, its action does not force the market prices of the two metals to remain in the identical or established ratio. On the contrary the two metals rarely stay on any level of parity for very long at a time. Into the constant fluctuation in ratios, technology enters fundamentally. Changes induced by scientific discoveries and inventions make variations in the output of the respective metals, gold and silver. This fact is clear and important although it has received little attention in discussions of monetary systems. Furthermore, developments in the techniques of extracting the two metals are in no wise related.

Gold and silver are generally mined for different reasons. The high value of gold encourages the extraction of that metal for its own sake. Silver, on the other hand, is commonly produced as a side line by copper and lead smelters, so that output depends upon the demand for the baser metals. As a result, progress in the metallurgy of the two substances does not and cannot run parallel. As we have seen, dynamite was responsible for a phenomenal rise in silver stocks during the period immediately after 1873. But no compensating invention struck the gold fields at the same time. When, more than a decade later, cyaniding came into vogue, the tables were turned, for now gold extraction multiplied four-fold while no such increase was recorded for silver. Evidently the supplies of the two metals cannot keep step.

Nor does the industrial demand for one metal closely correspond with that of the other. First, the industrial arts



consume about twice as large a percentage of the gold supply as they do of the silver supply. Secondly, differences in chemical properties, as well as cost, between the two metals are such that the invention of novel uses for gold may not affect silver at all, and *vice versa*. For instance, photography proved a big boon to the silver trade, while it scarcely touched the gold industry. Accordingly, there is no scientific justification for attempting to fix a legal ratio by weight between gold and silver money.

These obvious facts are reflected in the history of bi-metallic standards in the United States. In 1792 Congress declared that the silver in a silver dollar must be exactly fifteen times as heavy as the gold in a gold dollar. Shortly afterward the market ratio reached the point where a gold dollar would purchase fifteen and a half times its own weight in silver at the mines. Businessmen quickly took advantage of the differential. They could trade 10 pounds of gold for 155 pounds of silver, exchange 150 pounds of silver for another 10 pounds of gold less seigniorage and pocket the difference. The inevitable outcome was that a great volume of silver dollars was turned out. They were used everywhere and gold was driven from circulation, being too valuable by comparison to be employed in ordinary commercial transactions. To meet this situation, the government changed the mint proportions in 1834 to 16 to 1. As the regular sales quotations stood at  $15\frac{1}{2}$  to 1 for the moment, the innovation completely reversed the picture. Gold dollars displaced silver dollars. Eventually Congress saw the difficulty of trying to maintain parity and abandoned the effort by "demonetizing" silver in 1873. In 1900 the currency system of the United States was founded on gold alone. What might have happened if no alteration had been made is scarcely problematical, for in 1931 the silver-gold ratio, over the counter, had become 60 to 1.

**Contemporary Currency Ideas.** Although it was once fondly supposed by many economists that the principle of

the single gold standard for the currency had been established for all time, recent events have challenged it again. Can the technology of gold extraction and the opening of new sources keep pace with the multiplying transactions of commerce? So far as metallurgy is concerned, its discoveries and inventions bearing on gold output are hidden in the future, and hence beyond the calculations of economists. What will be the relative demand for gold on the part of the industrial arts? Here again science and invention hold secrets likewise concealed from economists. Faced with many uncertainties specialists in money are now beginning to consider revisions in the historic conceptions of money. Already we are seeing a "managed currency" deliberately manipulated in relation to gold by governmental control. Some are seeking to set up a currency basis in a composite commodity unit other than metals. The outcome cannot be forecast.

**Reconstruction of the Currency System.** Despite the uncertainties of metallurgy and the long experience of nations with currency manipulation, Congress conferred upon the President by the Agricultural Adjustment Act of 1933 the power to reconstruct the monetary system of the United States. Under this legislation, he may now establish the ratio of gold and silver and provide for unlimited coinage of both metals, accept silver to the amount of \$200,000,000 in payment of debts due from European governments and issue silver certificates based thereon, and emit \$4,500,000,000 in paper notes to redeem outstanding bonds of the United States Government. Under powers conferred upon the President, the payment of gold upon outstanding obligations of the United States has been suspended and gold notes and gold have been called into the Treasury.

**Currency and National Planning.** Whatever may happen in the field of currency and banking, it seems improbable that the Federal Government will return to exactly the same currency system in vogue before 1933, even though it is now impossible to forecast anything accurately. One reason for

this conclusion is that the currency system is vitally connected with the price stabilization program on which national planning for industry and agriculture now rests (below, Chapter XVIII). The currency system has some relation to price fluctuations, despite the fact that this relation cannot be mathematically determined by economists; and efforts of the Federal Government to balance production and consumption, inevitably involve some control over violent fluctuations in the currency. What kind of control, no one seems able to decide in a scientific manner. Since one or more metals are implicated in currency determinations, and since the volume of metals hangs upon technological and industrial processes, currency stabilization by the Government will seek a certain emancipation from the fortunes of metallurgy, inventions, chemical processes, and industrial uses connected with mining. Industrial stabilization on the basis of inherently instable metallurgical operations is a contradiction in terms.



## CHAPTER X

### WAR AS AN INSTRUMENT OF NATIONAL POLICY

**The Universality of War.** During the long process of human evolution, warfare has been one of the most powerful factors in political development. From the beginning of society it has been intimately associated with government. By the sword nations have been drawn into unity; by the sword their fortunes have risen or fallen; and by the sword they have perished. For centuries Europe has resounded with the tramp of armed men, and war has been the ultimate instrument of governments in the execution of their policies—maintenance of national unity, defense of national territory, realization of actual or pretended rights in aggression against neighbors, and the conquest of land and natural resources.

**American Experience.** Even America, despite her proud boast of being a peaceful country, has often made use of this mighty instrument of power. The United States was itself created in the midst of a prolonged war and revolution. Since its establishment, it has waged four major encounters with foreign foes—in 1812 with England, in 1847 with Mexico, in 1898 with Spain, and in 1917 with Germany and Austria-Hungary. In one of these wars large areas of territory, rich in natural resources for the uses of technology, were added to the national domain. And the very unity of the nation was preserved by arms, during the bitter Civil War, costing the Union forces alone 350,000 lives and the Federal Government more than a billion and a half dollars.

A series of minor encounters swells the American martial records. Innumerable brushes with the Indians, of course, accompanied the flow of settlers toward the Pacific. Vexed

at the capture of American vessels, the Government waged an informal naval campaign against France between 1798 and 1800. Refusing to suffer further indignities at the hands of the Barbary Pirates, or to pay tribute to insure the safety of American craft sailing in Mediterranean waters, it ordered the bombardment of Tripoli in 1805 and 1806, reducing to order the offenders against commerce. American cannon roared away at Kagoshima, in 1864, to punish the Japanese for firing on a small steamer. Joining with other Western powers, in 1900, the United States helped to conquer the patriotic "Boxers," or "Society of Harmonious Fists," in China, a group that had grown restless at the annexation of native soil by "greedy foreigners." At about the same time, an uprising of Filipinos, anxious for the independence denied them at the close of the Spanish War, was put down by guerilla tactics. In the Caribbean area, several thousand inhabitants of Haiti, Nicaragua, and Santo Domingo were killed as the result of collisions with American marines sent there to protect American "interests." A spectacular but fruitless chase into Mexico in pursuit of the bandit, Villa, costing \$130,000,000, enlivened the year 1916. Closely following the World War, American troops operated in Siberia against the Bolsheviks "to stabilize efforts at self-government." As a fighting nation, it appears, the United States has a direct and potent concern with military affairs.

**Engineering in Warfare.** In a strictly professional sense, engineers are involved in the art of warfare and form a mainstay of military and naval establishments. This has always been so. The earliest engineers were military engineers. The earliest engines were engines of war. It was not until near the middle of the eighteenth century that *civil* engineers appeared in history—men who were principally concerned with building roads, bridges, and public works for civil as distinguished from military purposes. As technology advanced and all branches of engineering were employed in warfare and preparations for war, the distinction

was almost lost, although the term "civil" engineer survives. It is not too much to say that modern warfare rests fundamentally on science and engineering, and uses all branches of technology. Moreover, in warfare, when vast energies and wealth are engaged, enormous advances in technology are made—in chemistry, aviation, radio communication, navigation, and on through the list. Technology makes war more and more deadly and destructive, victory more costly, and defeat more ruinous. Indeed as a Japanese statesman once remarked, Japan had to adopt Western machinery and industries for the sake of self-defense, if nothing else.

**Industrial Expansion and War.** In another way technology is related to war. The great military and naval powers of modern times are industrial powers—countries depending for their economic strength on coal and iron and making use of a bewildering variety of raw materials drawn from the ends of the earth. For the very regularity of their economic life, these nations rely upon the continuous import of materials and the export of manufactured goods. Finding their streams of commerce often interrupted by revolutions in distant places and by wars local and general, they have sought to secure a certain degree of independence by conquering and annexing "backward places" containing resources for industries and by dominating the sea channels of trade through naval superiority. Out of these efforts have come some of the greatest wars. At the very heart of the business is this fundamental question: Must each industrial nation seek to control by force its supplies of raw materials from abroad or is there some way of providing for the procurement of indispensable raw materials through the peaceful exchange of goods? The future of engineering work and of civilization may be said to depend upon the answer to this question.

#### THE MOVEMENT FOR INTERNATIONAL PEACE

**Praise of War.** Owing to the universality of war and preparations for war, the thoughts of philosophers have



been turned to the good and evil influences of war on national life. Many orators view armed strife as a distinct blessing. Out of conflict, they say, have sprung hundreds of heroes, whose prowess not only lends color to the pages of history but sets a noble goal for aspiring youth. These heroic characters, runs the argument, show how the soul can be lifted above mere interest in self to complete sacrifice. Fighting induces those accustomed to relative comfort at home to endure gruelling hardships at the front, toughening weak and flabby recruits into strong, vigorous men. Military discipline teaches the individual to take orders and to coöperate with his fellows. On the material side, domestic industries are stimulated, inventions are encouraged, and the surplus population is annihilated. Treitschke, the famous German political scientist said, years ago, that war is a "medicine for mankind diseased."

**The Destructiveness of War.** Refusing to accord virtue to war in itself and contending that it defeats its own purposes under modern conditions, critics of the above view declare that war is an unmitigated evil. With recent progress in technology, they urge, modern fighting has lost whatever noble qualities it may once have possessed, becoming little more than a process of gruesome scientific murder. Present-day machine guns fire 400 shots a minute, mowing down rows of soldiers with methodical ease. Armored tanks crawl through the lines, smashing such obstacles as barb-wire entanglements that lie in their way. Poison gas is hurled in clouds or released from specially constructed shells to choke and blister the foe. Wells are poisoned. There is talk of disseminating deadly bacteria and injurious insects by plane. Flame-throwers convert wounded soldiers lying in their way into human pyres. From the air above a rain of bombs is dropped on sleeping cities. Sappers dig under the enemy, to blow him up from below. At sea, both mines and submarines lurk in the depths, waiting for the passage of unsuspecting steamers. With these engines of destruction and

many others in use, it is inevitable that twentieth-century conflicts should take an appalling toll.

In the World War twenty-seven nations mobilized a total of 65,000,000 men, of whom 8,540,000 were either killed in action or died from service-connected causes, such as disease contracted at the front; 21,200,000 were wounded; 7,750,000 were reported missing, many being taken prisoner. This wholesale slaughter left behind 9,000,000 orphans and 5,000,000 widows. As one grim statistician figured it out, if all those who were killed and maimed, together with their widows and orphans, marched past a given point, 20 abreast, it would take 416 days for the column to pass.

To this heavy human sacrifice must be added losses of wealth—buildings, supplies, and equipment. The industries of all the leading powers turned from their normal work to devote themselves to pouring out necessities for the prosecution of the war. Almost as fast as the military engines were finished, they were battered and torn to bits. For example, one trim steamer after another was launched, only to collapse before deadly torpedoes—a total of 14,000,000 tons sank at sea. Altogether the expense of the holocaust was staggering. According to Professor Bogart, \$186,000,000,000 was directly spent for military and naval purposes in the war. At the height of the activity, in the fall of 1918, claims another writer, it took \$1,000,000 a minute to maintain the conflict. Nor did this fabulous wastage of blood and treasure produce beneficial results. On the contrary, it left Europe economically prostrate and psychologically distraught with hatred. A decade and more after the signing of the peace treaties, victor and vanquished still wrangle, still suffer, still seek revenge. Such a spectacle, say the critics, is proof that war is blind folly.

**Rise of the Peace Movement.** As a result of its own experiences and the lively debate now raging between pacifists and militarists, the general public seems to look with favor upon the settlement of international disputes by peace-

able means. At the same time it believes the goal to be difficult if not impossible to attain. Simultaneously, then, we find a strong movement in progress for the abolition of war and another parallel trend towards the increased armament of the several countries, "just in case something should happen." Both tendencies bear detailed examination.

**League of Nations.** Pacifists, drawing strength from World War experiences, finally succeeded in making themselves felt in the years immediately following that holocaust. Their first marked achievement was to secure the establishment of the League of Nations. Fifty countries are now affiliated in this organization with a view to providing common channels for the settlement of important controversies. Member states are pledged to preserve against aggression the territorial integrity and political freedom of their fellows. Each is bound to submit to arbitration or inquiry every problem that cannot be properly handled by ordinary diplomacy. Should any party ignore its solemn obligations, the League is empowered to bring pressure on the recalcitrant state, deciding on military steps in extreme cases. Operating on an independent basis are two supplementary bodies, the Hague Tribunal and the World Court, which offer their services in providing facilities for the settlement of disputes by amicable processes.

**Kellogg Pact.** A second milestone in the peace movement was reached in 1928 with the signing of the Kellogg Pact by the United States, England, France, Germany, Russia, and all the other leading powers. In Article I the contracting nations "solemnly declare in the names of their respective peoples that they condemn recourse to war for the solution of international controversies and renounce it as an instrument of national policy in their relations with one another." Article II announces that "the settlement or solution of all disputes or conflicts of whatever nature or whatever origin they may be, which arise among them, shall never be sought



except by pacific means." But these grand flourishes are weakened by many reservations. In the first place, the treaty permits military and naval operations in self-defense. Since modern states find many ways of avoiding the onus of being an aggressor, the exemption covers a multitude of sins. Furthermore, if one party resorts to arms, the others are forthwith released from their pledges and can start firing on the offender immediately. Nor is fighting forbidden on the part of the League of Nations, or by France in aid of certain Eastern European allies, or by England within her special "spheres of interest," or by the United States in support of the Monroe Doctrine. In short, the document is little more than an expression of a desire for, rather than a means of realizing, peace.

**International Trade in Arms.** Bending their efforts against the cause of peace are numerous private manufacturers of war supplies. The more distrust and fear they can create in the human heart, the larger the market they can open for their products. Thus on the 24th of March, 1933, a representative of Austria's biggest ammunition works was arrested in Rumania on a charge of espionage. It was alleged by high Rumanian officials that he had bribed members of the Ministry of War and various other politicians to obtain orders for his firm, and that he had spread false rumors of Soviet mobilization to frighten the nation into demanding arms. Another instance of the sort occurred in connection with the naval limitation conference at Geneva in 1927. After the meeting broke up without accomplishing anything, a certain William B. Shearer tried to collect fees from American warship builders for services rendered in preventing the gathering from achieving its goal. While military equipment-makers hide behind a cloak of patriotism, they sell goods to foreign powers that later turn out to be enemies and some of them have sold supplies to enemies in war time. British troops at the Dardanelles, during the World War, were shot down by British guns purchased by the Turks, just as other

Englishmen met their death a few years before at the hands of the Boers in South Africa, who likewise used rifles bought from English plants.

**Arms Embargoes.** Several means of restraining the ardor of private manufacturers of war materials have been devised. One of them has already been applied on a limited scale in this country—that of placing restrictions on the export of arms. Under a blanket act of Congress, the President of the United States may forbid the shipment of domestic munitions to Latin-American buyers. Taking advantage of the authorization, several proclamations have been issued by Chief Executives, one of them by President Hoover in October, 1930. The 1930 edict prohibited the delivery of equipment to bands of rebels, then in open conflict with the established federal administration of Brazil. Naturally it did not affect purchases of military necessities by the latter. On the contrary, our Navy temporarily released an American airplane plant from its agreement to deliver three patrol planes in order that they might be dispatched immediately to the aid of the recognized forces. In brief, the United States has employed the embargo principle only to preserve the internal stability of friendly powers.

Having tinkered with the embargo idea on a small scale, some Americans now suggest more extensive application of the principle. In 1933 the Committee on Foreign Affairs of the House of Representatives in Washington rendered a favorable report on a bill containing sweeping provisions. It would grant the President of the United States complete authority to prohibit the shipment of arms and equipment to countries engaged in actual warfare. By this means, it was said, aggressors might be penalized, potential enemies forced to go elsewhere for supplies, and foreign affairs stabilized. Special interest attached to the measure at the time on account of Sino-Japanese difficulties in the Orient. But, of course, any action taken by the United States, working alone, would not be decisive. Two other powers—England

and France—are larger exporters of military paraphernalia than is the United States; they might sell war materials after the latter had refused to do so. Consequently an international agreement for the general boycotting of warring states has been suggested, and a few American diplomats have placed themselves on record in support of the proposition. Important developments in this field may be expected, developments that may enable great manufacturing nations to stop hostilities abroad by remote control—a curious result of technology.

**Taking Profit Out of War.** A more extreme proposal is to forbid munition concerns to operate in domestic as well as foreign markets by declaring the manufacture of munitions to be a government monopoly. Naturally this step would not prevent ordinary business concerns from benefiting by the unusual demand for collateral supplies that accompanies the outbreak of hostilities. Industrial leaders in general might still be tempted to encourage mobilization for the sake of temporary “prosperity.” Even this incentive would be automatically removed if the suggestion of President Gifford of the American Telephone and Telegraph Company should be adopted. In his opinion, Congress should not permit private corporations to realize excess profits during conflicts to which the United States is a party. To carry the policy into effect, private incomes would be taxed at rates which would bring all, or substantially all, net gains above normal returns to the national coffers. What the proposition might mean in actual practice is revealed in World War records. According to Federal tax returns, American enterprises made \$38,000,000,000 in clear profits between January, 1916, and July, 1921—a period of preparation, conflict, and readjustment. This sum would have been more than enough to cover the entire cost of American participation, if it had been taken in taxes by Federal authorities. The net result of such drastic action, in any event, would be to force every undertaking to sacrifice time and effort to the



task of defeating the foe, rather than to fattening its pocket-book out of a common tragedy. Surely there can be little objection to the principle on patriotic grounds, and certainly it would aid the cause of friendly trade.

### THE LIMITATION OF ARMAMENTS

Less ambitious than general and drastic schemes for maintaining world peace are plans for the limitation of armaments. Although such plans are sometimes supposed to contribute to upholding international peace, they are not necessarily so conceived. Indeed they may spring from a desire to curb the growing strength of a dangerous rival and to secure more favorable conditions for carrying on the next war. Whatever the motives behind arms reduction, the principle has won widespread acceptance. Indeed, it seems to offer the only immediate escape from expensive and ruinous rivalry leading to certain war.

**The Armaments Race.** For many years increases in the armaments of one country stimulated corresponding growths in the military and naval units of its rivals. As long as equipment remained comparatively simple this "race" was not unduly expensive. But with the development of modern engines of war, the cost of such competition mounted to fabulous heights. The absurdity of the practice became self-evident. States that were once on an equal footing, with comparatively poor equipment, might, after large increases, still be on a parity but on a greatly expanded plane. Often a country had no better advantage over its rivals than before, while its taxpayers were distinctly the losers. As a remedy, it was suggested that the leading powers draw together, restricting their warlike preparations by joint agreement in such a manner as to maintain a certain balance of strength and simultaneously save vast sums of money. To this movement the United States has lent its support. Although the proposal has encountered the inevitable international jealousies, it has nevertheless won limited triumphs.

**Washington Naval Conference.** Today, the United States is restricted in the size of its naval armaments by international agreements. As an initial step in this direction, a conference was held in Washington, D. C., in 1922-1923, attended by leaders from the world's five greatest sea-powers—the United States, England, Japan, France, and Italy—as well as by representatives of four other countries. After prolonged debate, the assembled representatives finally agreed upon a treaty which was ratified by five participating countries. Basically, it restricted until 1932 the total tonnage of two major classes of vessels which the several nations were entitled to operate. In the battleship category, the United States and England were granted parity with 525,000 tons apiece, Japan was placed in an intermediate position with 315,000 tons, while France and Italy were assigned quotas of 175,000 apiece. Almost the same ratio was fixed for aircraft carriers, the figures being as follows: United States and England, 135,000 tons each; Japan, 81,000 tons; and France and Italy 60,000 tons each.

Dealing with individual ships in detail, the treaty provided for a systematic schedule of replacements. On the assumption that a battleship becomes obsolete twenty years after the date of its commissioning, three years prior to the expiration of this term work on a vessel of like size and class may start. Immediately upon the completion of the latter, the worn-out craft must, of course, be retired and scrapped. Similarly, unexpected losses from storm and explosion may be replaced by new construction. However, the desire for economy prompted the framers of the compact to forbid the initiation of any program of substitution until after 1931. Since the five powers were virtually built up to or beyond the maximum allowable battleship tonnages at the time the agreement was signed, this ban resulted in a partial "naval building holiday," for a period of years.

Detailed specifications were also drawn up to control the fighting strength of individual craft. The maximum gross

size of vessels was carefully fixed. For battleships, a limit of 35,000 tons apiece was set, the object being to call a halt in the race for supremacy that had culminated in the launching of the 41,200-ton British *Hood*. Aircraft carrier dimensions, too, were held down. A standard bulk of 27,000 tons or less was set for this group, though each nation was allotted a couple of vessels of 33,000 tons apiece. In addition to considerations of weight, permissible armament was closely defined—no battleship being allowed guns of over 16" caliber and no aircraft carrier guns of over 8" caliber.

Special clauses in the document forbid international transfers of naval apparatus in time of war that might upset the existing balance of power. Thus signatory countries are forbidden to seize any ship being built in local yards to the order of a foreign state. For instance, a cruiser being assembled in a British plant for some South American republic cannot be taken for use in the English fleet in an emergency. To protect parties to the agreement from external harm, none of them is permitted to construct vessels for outsiders that exceed in fighting ability the craft belonging to signers. In addition, intramural sales of fleets are outlawed; that is, France cannot buy warships from Japan with which to attack Italy.

Naval bases, as well as craft, are dealt with in the treaty. Due to the enormous horsepower necessary to attain the high speeds required in modern manœuvres, many American ships must refuel to cross the Pacific at top speed. Hence stations for that purpose are required at strategic points over the area. British and Japanese vessels face identical problems. Owing to the fact that Japan was reluctant to cut her building program, without compensatory concessions, the United States was finally induced to guarantee her against improvements in American facilities in the Far Pacific. As ultimately worded, the treaty required America, England, and Japan to refrain from adding to or improving



their fortifications in that region (excepting Japan, on her mainland) at any time after the treaty became effective.

**Geneva Naval Conference.** Having called a halt in their capital ship programs at Washington, the signatory countries turned their attention to cruisers and other craft not yet restricted in tonnage and number by international agreement. Soon a new armament race was on, threatening to bring back the old evils of expensive competition. Trying to stem the tide once more, the United States proposed another conference, to deal with smaller vessels. While the five powers that had appeared at Washington were requested to attend, France and Italy became distrustful of each other and refused the invitation. At Geneva, in 1927, representatives of the three remaining parties assembled, but accomplished nothing.

**London Naval Conference.** Following the failure at Geneva, the race for supremacy in cruisers and smaller craft continued unabated. Not only that. In 1931 the capital ship replacement holiday inaugurated under the Washington treaty was due to expire. Unless immediately extended, a series of expensive battleships would be started in the near future to serve as substitutes for obsolete vessels still in commission. These events called for prompt action. Agents of the United States, Great Britain, France, Italy, and Japan met in London in 1930 to discuss these problems of the day. France and Italy resumed their former quarrel over relative strength and so were unable to ratify the treaty in the end; but the final document bound the three remaining sea-powers. To protect the trio, the agreement provides that in case outsiders should embark on a wholesale program of launchings, threatening the security of signatory countries, the latter are automatically released from the compact and can at once begin compensating construction.

As finally ratified, the London compact reënacted the terms of the Washington treaty insofar as they apply to the aircraft carriers of the United States, England, and Japan.

In the matter of battleships, the agreement extended the holiday on replacements for another five years—until 1937. To the relief of the world's taxpayers, the total permissible tonnage of such floating fortresses was reduced. The combined allowable tonnage for all American battleships was to drop from 525,000 to 462,000; the British tonnage was to fall from 525,000 to 474,750; and that of Japan from 315,000 to 266,070. As the three signatory nations had already built up to the Washington maxima, the slash necessitated the actual scrapping of a number of boats.

Going a step beyond the Washington treaty, the London agreement sought to stop the race for supremacy in small craft by allocating the latter among signatory countries on a quota basis. By its provisions, in 1937 the tonnage of these minor vessels must not exceed the following limits: for submarines, 52,700 tons for each nation; for destroyers, Japan 105,500 tons, and the United States and England each 150,000; light cruisers, Japan 100,450 tons, America 143,500 tons, and England 192,200; heavy cruisers, Japan 108,400 tons, America 180,000 tons, and England 146,800. American preponderance in heavy cruisers is offset by British supremacy in the light cruiser field. Besides placing restrictions on totals for the various classes of equipment, the compact specified in detail the maximum size and armament for individual vessels. Each power was allowed three submarines of 2,800 tons apiece, the remainder to be not over 2,000 tons apiece. Heavy cruisers must not displace over 10,000 tons nor carry guns of over 8" caliber. Light cruisers were in turn assigned guns of 6.1" or less caliber.

**The American Navy Approaching Treaty Strength.** Should the American navy be expanded immediately to existing treaty limits? The question is a hard one to answer, as pointed out below, for the optimum tonnage depends upon so many intangible variables as to render exact computations impossible. For a time, however, the advocates of economy had the upper hand, committing the country to a

policy of keeping well within the legal maxima. Thus in 1931 the United States was entitled to build 43,700 tons more of aircraft carriers, 30,000 tons more of heavy cruisers, 73,000 of light cruisers, 49,000 of destroyers, and 1,650 of submarines. In contrast with American shortage, British and Japanese fleets were said to have reached almost full strength. But in 1933 the United States embarked on a huge and costly program designed to bring its Navy up to full treaty strength, in the guise of "public works."

**Naval Limitation in the Future.** If naval limitations are to be really effective, much work remains to be done. France and Italy must be reconciled, and along with a number of other countries induced to sign fundamental agreements for reduction. Besides increases in the geographical scope of international understandings, the range of equipment covered should be broadened to encompass new classes, such as dirigibles. Finally the practice of setting quotas at such a high figure as to require the launching of thousands of tons of additional units must be abandoned. In its place, maxima should be fixed at such low levels as to compel the scrapping of large quantities of vessels now afloat. Only by this means can taxpayers be relieved of heavy financial burdens.

**Limitation of Land Armaments.** A few attempts have been made to limit land forces as well as warships. In the Versailles Treaty that closed the World War, the Allies forcibly disarmed Germany as a temporary safeguard against repetitions of her military operations. Seeking to cast a moral light on their work, they declared this action to be but a preliminary to general international restrictions. As a gesture to this noble pronouncement, the League of Nations finally appointed a committee to study the feasibility of reducing armies everywhere. After several years of labor it had laid the foundation for a great conference. So in 1932 representatives of about fifty countries met at Geneva to deal with the proposals, but they went away unsatisfied.

Technically, the problem of limiting land armaments is



extremely complicated. Guns, poison gas, and similar equipment can be produced or purchased from outside sources on very short notice, enabling a country to overcome existing restrictions within a few weeks after declaring war. Furthermore stores of supplies can be secreted from prying eyes, making it difficult for one nation to check up the equipment possessed by another. An astonishing array of weapons, whose relative power is hard to judge, baffles the expert who seeks a common measuring rod for fighting ability. As for navies, the situation is very different. It takes a long time to construct a battleship or cruiser. Nor can huge craft be successfully hidden from view. Therefore it is not surprising that naval agreements have progressed much further than those for the restriction of land armaments.

**What Is to Be Defended?** Institutions and proposals for the maintenance of peace and the limitation of armaments are based on the assumption that each country retains its right of defense. That seems axiomatic—and clear until it is examined. The size of the army and navy required by that principle depends upon what is to be defended. To this question two answers have been made by the United States. One is that the Government is bound to defend not only the continental domain but all American citizens and interests in every quarter of the globe. The other, more conservative in character, is that the United States should play the rôle of “a good neighbor,” and be content with the defense of its continental territory, the Hawaiian Islands, and its Caribbean possessions. On this issue public opinion in the United States seems to waver, without arriving at a positive conclusion.

Yet certain outstanding facts seem to point to definite limitations on the scope of defensive and aggressive actions. Under the restrictions placed by treaty on naval armaments, it is physically impossible for the United States to defend its citizens and their property in Europe or the Far East against any or all the great powers that might be involved: the ratio

of 5-5-3 will not permit it. Even if these international restrictions should be discarded in time and the United States should attempt to build a navy large enough to cope with Great Britain in the Eastern Atlantic or Japan in the Far East, would these powers sit idly by and see unquestionable American supremacy established in their waters? There is no reason in human experience to believe that they would.

It would seem to be the better part of wisdom, therefore, for the United States to work for an all-around reduction of armaments that would leave it in the same relative position for defense, to concentrate on the protection of the continental domain and neighboring waters which can be defended with some assurance of efficiency, and to avoid policies and commitments that might involve the country in wars beyond its competence. This may not be pleasing to those who think "America can lick creation," but it offers an easy way of reducing the heavy burdens of armaments and maintaining at the same time a high degree of national security.

#### THE AMERICAN WAR MACHINE IN TIME OF PEACE

**Civilian Control.** Familiar with the long history of war and facing two great military powers near at hand—Great Britain in Canada and Spain to the West and South, the framers of the Constitution made provision for an army and navy and for drawing into Federal service the militia of the states. Knowing that governments had often been overthrown at home by military forces, they believed it unsafe to place professional warriors in supreme command of the fighting units, for fear they might suppress personal liberties and rush the country into unnecessary conflicts. So the founders of the Republic vested supreme control over the Army and Navy in civilian authorities. The armed forces of the United States are subject to orders of the Secretaries of War and the Navy, who are laymen directly responsible to the President as Commander-in-Chief. Congress has the exclusive power to raise and support military and naval

establishments, to make rules for their government, and to declare war. In the same way the militia of each state is provisioned by the legislature and commanded by the governor. Throughout, therefore, civilian chiefs serve as connecting agencies between the general public on the one side and technicians trained in war on the other, presumably holding the latter in check.

**The Volunteer Basis of Armed Forces.** Not only are American forces in civilian hands; they are recruited entirely from volunteers in peace-time; that is, soldiers and sailors, officers as well as men, are in the service from free choice. The only instance of compulsory training is in the case of students in land-grant colleges who are often required to take prescribed courses in the art and science of warfare. Americans generally seem to favor this practice of voluntary recruiting as an alternative to the European custom of compulsory training. In several foreign countries, every male citizen, between certain ages, must report for duty whether he likes it or not. France conscripts men for one year, beginning immediately after their twenty-first birthday, while Italy has adopted an eighteen months period. It is argued in favor of the American policy that it is less apt to breed militarism in the community.

**Regulars.** Turning to the organization of our defense forces, we find them classified into permanent units and reserves. The former consist of men who devote all or a considerable part of their time to intensive training for combat so that they may be prepared to fight on a moment's notice. Operating directly under the Federal Government are two major agencies of this type. For land service, there is the regular Army. For service in territorial waters and on the high seas, there is the Navy. Prominent as a subdivision of the Navy are the United States Marines—forces capable of work both ashore and afloat, combining the duties of army and navy in one. They figure a great deal in current news on account of the fact that they are often em-



ployed in weak countries, without creating a formal state of war.

American states, too, are supplied with permanent forces. Every one of them has a land unit, known as the National Guard, or Militia. It is organized on the pattern of the regular Army, receiving a measure of financial support and direction from the Federal Government. Nevertheless it remains essentially a local agency, being employed normally to handle local emergencies. A few states have gone a step further and established naval militia outfits. The pioneer group was formed in Massachusetts in 1890 and since then other communities along the seacoast or bordering the Great Lakes have followed suit. The prime weakness of the militia system is that members devote but a small fraction of their time to combat training, being free to keep at their private employments in the ordinary manner. Inevitably their proficiency in the art of war suffers.

Altogether the permanent armed forces of the United States total approximately 400,000 men, distributed as follows: Federal Army, 140,000; Federal Navy, 95,000; and state militia, 180,000.

**Reserves.** Forming a second line of defense are various reserve units. Some of these are Federal, among them being the Organized Reserves attached to the United States Army. This major group is divided into two classes. First there is an Enlisted Reserve Corps, composed of a limited number of individuals ready to serve as privates in case of war. While it is impractical to train a sufficiently large mass of citizens by this means to fill the ranks in time of conflict, it is feasible to educate the necessary officers. Consequently an Officers Reserve Corps of 100,000 men has been established. They stand prepared to take immediate command of the large body of raw recruits that will be called to the colors in the event of war.

Aspirants for posts in the Officers Reserve Corps pass through a prescribed preliminary training routine. Some of

them, between the ages of seventeen and thirty-one, are given a month's free course at a Citizens Military Training Camp each summer and after attending a sufficient number of encampments they are enrolled in the Corps. An alternative route is through the Reserve Officers Training Corps. In schools and colleges all over the country, the Government gives young men rudimentary instruction in military science. Individuals completing the specified work are entitled to commissions in the Corps. After becoming bona-fide reserve officers, men are given short practice periods every now and then—just enough work to keep them acquainted with the elements of army technique.

Like the Army, the United States Navy, including its subdivision, the Marines, maintains reserve units for officers and men. Here again we find commissions being issued to those who have first completed prescribed courses given in schools and colleges to persons interested in mortal combat. Not to be outdone by the Federal Government, the several states have established similar groups to support their militia or national guard units. Taken together, the regular forces and the reserves constitute the peace-time fighting organization.

**Efficiency of the Reserve System.** How efficient is this complex organization, from a purely military standpoint? There is no doubt that the regular Army and Navy men get a stiff training. But under the part-time volunteer system the remaining men do not. The National Guard merely has occasional drills, with reserve units getting even less attention. As for the Reserve Officers Training Corps, it is relatively ineffective. In an attempt to enlist students, it tries to make the service unduly attractive by leaving out bayonet drills and other unpleasant features of actual warfare. In their place are inaugurated parades, contests in which beautiful "co-eds" pin medals on experts in the manual of arms, and other embellishments. Despite such showy efforts, involving the expenditure of \$2,500,000 in 1930, only a hand-

ful of recruits were interested enough to join the reserves on the completion of their studies. Owing to this inadequate preparation, compulsory and universal instruction has been suggested. However feasible it may be in Europe and the Orient, it seems to be beyond the range of practical politics in the United States.

**Reserve Supplies.** Modern warfare is more than a struggle among men; it is a battle of machines. Consequently it is imperative that soldiers and sailors be equipped with the latest instruments and materials. So a considerable reserve of bullets, rifles, tanks, aircraft, and other equipment is kept on hand in peace time, although the total size of these stores is limited by a desire to prevent unduly burdensome economic waste through deterioration and obsolescence—constant change in the design of deadly weapons making the latter a very important item. In practice present stocks would run out in a relatively short campaign. In fact the Assistant Chief of Ordnance, United States Army, stated in 1929 that existing ammunition dumps for the basic field gun, the 75 mm. piece, would last but four months in a major engagement, while small arms rounds would be exhausted in less than three months. What would happen at the termination of this brief period?

**Plans for Industrial Mobilization.** Government arsenals, of course, would be ready to turn out additional equipment on very short notice. But their capacity is sufficient to meet only a small proportion of the wartime needs. Thus it was recently estimated that government production could satisfy but five or ten per cent of the total requirements in a major engagement. The balance, obviously, would have to be manufactured by private plants, the majority of which would have to undergo substantial alterations in methods and machinery to do the job properly. If the country should again be caught as unprepared as in the World War, it might once more have to spend between fifteen and twenty-four months in diligent effort before military supplies could flow



to the front on schedule. With current reserves due for exhaustion in three to four months, the country would be left defenseless for a dangerously long interval. Wisdom dictates that there should be planning for industrial mobilization in advance, to reduce this period to a minimum. Consequently, a special body of Army men has been assigned the task of making a continuous study of existing facilities and the means for their utilization, so that a clear-cut program of action may be available for immediate application in an emergency.

As the Army industrial mobilization program is mainly paper, it has been proposed that the scheme be tested through regular factory drills. The suggestion has been advanced that "educational" contracts be let to private concerns for furnishing limited quantities of munitions or other military equipment in times of peace. Each accepting company would have to turn a portion of its force away from their regular duties, and alter some of its equipment in order to fill the requisition. By actual experience, then, manufacturers would be given a chance to see how problems in the mass-production of special supplies could be solved. The best steel to use, the accuracy with which it can be machined, the cost of production, the time required for completion, would all be recorded, furnishing valuable data for future reference. By undertaking these experimental jobs at intervals of five years or so, current advances in the arts could be applied, and novel difficulties ironed out at leisure. To date, however, the policy has not been tried.

**Veterans Considered Deserving of Reward.** Besides the men who stand prepared to wage future wars, there are many who have already discharged heavy obligations to the nation on the field of battle. Perhaps these veterans were conscripted against their will, and badly crippled for life in the bargain. Or maybe they sacrificed time and money to volunteer, undergoing in addition severe hardships while those who stayed at home reaped greater economic rewards and escaped the hazards of war. In any case simple justice

demands that the government and public they have tried to serve should show their gratitude. Consequently Federal and state authorities have generally taken upon themselves the task of alleviating suffering among, and otherwise rewarding, ex-service men.

**Pensions to Veterans.** Financial aid is often tendered. Usually this takes the form of pensions to ex-service men and their dependents. Account is taken of the worthiness of each beneficiary, for it would be burdensome to pay annual stipends to all troops returning from a war. Nor would it be necessary, for many can maintain themselves. In the circumstances it has been the general custom, at the close of each war, to award pensions only to persons hurt in line of duty and to the dependents of those killed or injured. At a subsequent date all veterans, whose natural infirmities prevent them from earning a livelihood unassisted, are then put on the pension rolls. As the years pass and the ranks are thinned down to meager proportions, every soldier and sailor who participated in a given conflict can claim a pension on account of age.

**The World War Bonus.** Departing from precedent, the Federal Government provided veterans of the World War with a novel type of financial aid. Feeling conscience-stricken, perhaps, for having paid the troops so little at the front, when civilians at home were reaping unusual profits, Congress originated the bonus plan. As an outright present to those who returned home alive, an award of \$1.25 per day for overseas service and \$1.00 per day for service in the United States was made, there being of course a few minor exceptions. Those entitled to relatively small amounts, under this system, were given cash, the remainder receiving their allotments in the form of life insurance certificates. During the depression beginning in 1929 a strong agitation in favor of the redemption of all or a substantial proportion of the annuity paper by cash payment resulted in provisions for advances in the form of loans at a lower interest rate. De-

mands for outright payment in full continued, despite the state of the nation.

**Institutional Care of Veterans.** In addition to its financial aid, the Federal Government provides former soldiers and sailors with places in which to spend their declining years. A number of Federal homes are scattered over the country, their facilities being supplemented by numerous institutions run by the states. Not only do the aged receive attention, but the sick and injured are given free medical treatment in a chain of national hospitals. Here hundreds of patients, suffering from shell shock, gas attack, tuberculosis, and other ailments are treated with the most modern curative methods. Altogether the cost of veterans' care has been stupendous. It is estimated that between 1792 and 1930 a total of \$15,-000,000,000 was spent for this purpose, with no prospect of an end in the expense for another three-quarters of a century.

### THE WAR MACHINE IN ACTION

**Mobilization of Enlisted Forces.** Immediately after a declaration of war, Federal authorities begin to mobilize the necessary men for action at the front. Peace-time units, drilled and ready for battle, form the nucleus of the advance guard. First the regular Army and Navy are put into action. To reënforce them, the units of state militia are called out. As rapidly as the latter organizations assemble, they are mustered into the national service, henceforth operating as integral parts of the regular Army and Navy. Thus divested of their local character, they obey the President of the United States rather than the governors of their own states. If the struggle creates a demand for additional troops, the organized reserves are told to report for duty at once. As a supplementary source of troops, a proclamation may request volunteers to join the ranks as raw recruits. By such means every person who is both able and willing to fight is given a fair chance, while nobody has been taken away from home without his consent.



**Drafts.** But not every man is so fired with reckless zeal that he is willing to risk life and limb or endure the severe hardships of the trenches. In fact during our two major struggles—the Civil War and the World War—the scarcity of volunteers markedly impaired the fighting strength of the Army and forced the Federal Government to resort to compulsion to fill the ranks. A system was provided whereby every able-bodied eligible within given age limits was required to register with the proper local officers. At an appointed hour the names of those who had to go to the front were drawn by lot. More than three million men were drafted to participate in the war against Germany and Austria. Of course there were exemptions. Thus persons under eighteen or over forty-five years of age were excluded in 1917–1918 as unsuitable material, with individuals who were excused from duty on account of conscientious objection to bloodshed on religious grounds. Unique among loopholes during the Civil War was the practice of permitting a conscript to hire a substitute to serve for him, or, failing that, to escape danger by paying an outright indemnity of \$300 to the Government. That expedient was not tried in 1917. In any event, the draft arouses strong popular feelings. In Civil War days they culminated in a riot in New York City.

As an act of justice to men called for duty in 1917 and 1918, Congress passed laws to assist their dependents. To wives, children, and other dependents of troops at the front, the Government paid limited allowances to supplement such portions of the regular Army wages as trickled home. In cases of disability or death, wives and children were the recipients of special compensation. Moreover, members of the armed forces were permitted to take out life insurance at very reasonable rates, considering the high risks involved, further to protect their dependents and relatives. Thus is man-power mobilized for combat service.

**Mobilizing Labor behind the Lines.** Besides assembling men for combat duty, the Government has to “mobilize” a

great mass of workers behind the lines in order that a sufficient stream of food and supplies may flow to the troops. It has been estimated that from three to twenty adults were required to maintain a single soldier on the firing line during the World War. As the strength of the American forces under arms was nearly 4,000,000 on Armistice Day, 1918, millions of civilians had to lend a helping hand in sustaining them. Moreover the departure of thousands of able-bodied men for the sphere of battle and the shifting of other thousands into gas-mask, bomb, training-plane, and other manufacturing plants left a mere skeleton organization on hand for the operation of many concerns, such as railroads or municipal utilities. Not only were the occupations of multitudes changed, but each individual had to achieve a more than normal efficiency in order that the whole enterprise might go on. Under a régime of technology, then, warfare drives almost everyone—women as well as men—into emergency action. As President Wilson said at the time: "In the sense in which we have been wont to think of armies, there are no armies in this struggle. There are entire nations armed . . . It is not an army that we must shape and train for war; it is a nation."

Three important Federal agencies were created to deal with the novel labor problems presented by the World War. In order that men and women might be placed in positions where they would be of utmost use in meeting emergency demands, a special employment office was established, with branches scattered over the country. To care for the interests of these individuals after they were once employed, the War Labor Policies Board was set up. This body surveyed current wages, hours, and other economic factors with a view to developing satisfactory conditions for all operatives. Yet despite its efforts numerous disputes threatened to interfere with normal production in many centers. So in April, 1918, the War Labor Board came into being with the announced purpose of clearing away such obstacles to maximum effi-

ciency as strikes and lockouts. Controversies between workers and managers, involving war industries, were put before it. While the Labor Board had no direct power to compel either side to abide by its decisions, it nevertheless achieved its purposes by indirect methods. Pointing out that national authorities might be forced to take over and run factories if they could not otherwise maintain full schedules, it could bring pressure to bear on owners and drive them to terms. At the same time strikers, who had been exempted from the draft on account of their value to skilled trades supplying troops at the front, could be warned that their immunity might cease if they continued to be recalcitrant. A word to the wise was often sufficient.

**Mass Education.** Behind the war were marshaled such popular institutions as schools, churches, and the press. To supply them with great masses of material, a Federal Committee on Public Information was created, which disseminated millions of pamphlets, supporting the Government's stand in the European conflict by laying emphasis on such ideals as "making the world safe for democracy" and the "crushing of autocracy." To prevent counter-propaganda from reaching serious proportions, a number of actions were formally prohibited. Under the Espionage Act of June, 1917, heavy penalties were provided for attempts to undermine the morale of American troops by the circulation of false statements, by trying to stir up mutinies, or by otherwise promoting disloyalty. Agitation against war among the rank and file of civilians was also proscribed. By the Sedition Act of May, 1918, punishment was meted out to all persons "who use abusive language about the Government or institutions of this country, who advocate or incite any curtailment in the production of war materials, and who by word or act favor the cause of the enemy country." So much for the strictly human phase of the contest.

**Organizing Industry.** On account of the prodigious quantities of food, fuel, machinery, and other supplies required



both at the front and behind the lines during the World War, industries had to be mobilized at once. A large part of the task fell on the War Industries Board, a specially constituted Federal agency. It began its work as a fact-finding unit. An exhaustive survey of the needs of American and Allied troops and civilians for essential commodities was hurriedly made. At the same time the capacity of all available plants was recorded, revealing potential abilities for meeting current demands. A complete picture of existing conditions was thus assembled, affording a basis for planned action.

Such information revealed that the industrial structure, as it then existed, could not carry the new burdens of essential wartime production. As a result, the Board embarked on an extensive program of reorganization. As an initial step, various industries were classified in the order of their military importance. Thus munitions plants headed the list, while perfume or candy factories were dropped to the bottom of the scale. By means of a system of priorities, Federal agents gave the right of way to the most vital trades, at the expense of the remainder. That is, a rifle works would receive consideration in the allotment of fuel, railroad cars, and raw materials, before a bath-tub concern. A number of enterprises were, therefore, either shut down of necessity or else converted. The Otis Elevator Company, for one, turned from its normal pursuits to supply 244 mm. recuperators. Construction units were especially hard hit, for under Federal restrictions the erection of any building at a cost of over \$500 was forbidden unless special permission was obtained from the Government. The erection of private houses and apartments remained at a standstill.

After clearing the way for essential trades, the task remained of increasing their output to a maximum through the elimination of lost motion. For example, Federal agents interviewed clothing companies, asking them to hold style changes at a minimum, to produce fewer designs in fabrics, and to do away with frills that might consume unnecessarily

large yardages of cotton and wool. The trend towards standardization was extended into many other lines of business, cutting costs of manufacture as well as the space required by dealers for storage. Over 3,000 surplus types of agricultural implements alone were abolished—303 patterns of plows being slashed to 65; 300 corn planters and drills to 10; and 107 harrows to 44. By numerous methods, an amazing amount of waste was eliminated from the industrial structure in a burst of patriotic fervor.

In the face of an avalanche of orders for commodities, markets became unsettled, giving unscrupulous individuals an opportunity to profiteer from the common misfortune. To put a stop to this condition, Federal authorities were vested with the power of fixing catalogue values for entire trades. Surveys were made of the history of specific businesses and of the true costs of production. With these data at its disposal, the Price Fixing Committee of the War Industries Board set up schedules of reasonable prices. Owing to the rapid developments at home and abroad, these levels were made effective for only three months at a time. Upon the expiration of each period, they were revised for enforcement during another quarter. Among the articles on which official quotations appeared were iron and steel, wool, hides, aluminum, manganese ores, lumber, sulphuric and nitric acid, copper, hemp, and Portland cement.

Industrial efforts were also coördinated with those of our foreign Associates in the War. France and England, having been in the war from the beginning, had already expanded their facilities until they could equip American troops with relative ease. France alone was said to be capable of supplying American forces with adequate stores of artillery and ammunition without depriving her own forces of weapons. But plants abroad were short of raw materials and certain component parts and the major task of the United States was to bring in these items, rather than finished products. For example, in August, 1918, while the Germans were

being pushed back, stocks of 75 mm. shells were seriously depleted, reserves being quickly cut in half. French munitions works were running far below capacity, owing to a shortage of steel; so they called for immediate shipments of huge quantities of this essential material. Three weeks later American metal was pouring into France.

**Control of the Railroads.** Such unprecedented industrial activity inevitably threw unusual burdens on the nation's transportation facilities, a load which they were not equipped to carry. For a number of years the various railroad companies had been fighting one another for business, the Government encouraging competition through legislation. Inevitably the resulting lack of coördination was responsible for a great deal of lost motion. Furthermore, difficulty in procuring adequate capital had restricted the expansion of many companies. Realizing that wartime demands could only be met through coöperative planning, railway corporations voluntarily formed a committee of control, with power to supervise the work of members. But this loose arrangement failed to adjust finances and other details to the satisfaction of participants. After several months of confusion, the United States authorities stepped in, took over the railways, and placed them in charge of a new body, the Railroad Administration. Regional managers, together with their staffs of subordinates, were appointed by, and made directly responsible to, the freshly created agency. Frequently private executives of long service lost their posts to new men, more sympathetic towards official policies. Many economies were effected, train schedules being quickly rearranged, cars shifted freely between roads, and terminals combined. As an act of justice to security holders, the Government agreed to pay fair compensation to the owners for the entire period of its formal stewardship.

**Management of Shipping.** Graver than the railroad situation was that of shipping. Thousands of men and hundreds of tons of material had to be carried to Europe, and in a



hurry. Consequently Congress took drastic steps, vesting generous powers of control over high seas transportation in an official agency—the United States Shipping Board. This body lost no time in taking charge of the skeleton fleet of merchantmen then available for war duty. As a starter, it was assigned the German liners seized in American ports at the outbreak of hostilities—ninety-one with an aggregate tonnage of 600,000. After they had been refitted, and the sabotage committed by their crews prior to departure had been repaired, they were placed in immediate service. Existing steamers in private hands were also requisitioned. Every finished boat of 2,500 tons burden or more, suitable for ocean navigation, was taken over. A few of the desired bottoms were even transferred by an ingenious device from the Great Lakes to the Atlantic Seaboard. Sixteen of them, to be exact, were too large to clear canal locks en route; so they were sliced in half, towed through, and reassembled upon arrival. In most cases craft were rechartered to the companies that had formerly run them, the terms of the contract leaving ample room for strict national supervision. In order that partly constructed vessels in American yards might be rushed to completion, 413 were transferred to the Federal authorities, representing a tonnage, when done, of 2,940,000.

After seizing all completed or partially completed vessels, the Shipping Board was still short of troop and cargo accommodations. So private organizations were encouraged to build additional craft on a gigantic scale. Designs were standardized, and the necessary interchangeable parts were manufactured at points scattered throughout the nation. Finished pieces were rushed to the coast by the trainload. To provide ample facilities for the assembly of this steady stream of components, existing yards were quickly extended in size, and supplementary yards were constructed at strategic points. Some idea of the magnitude of the necessary expansion may be gained from the fact that the largest



*Photograph by Brown Brothers*

### RELICS OF INDUSTRIAL MOBILIZATION DURING THE WORLD WAR

A portion of the large fleet of ships built to carry men and materials to Europe during the World War (see opposite page), tied up in the Hudson River upon the return of peace.



*Photograph by Acme Newspictures, Inc.*

### THE INFLUENCE OF TECHNOLOGY ON WARFARE

American airplanes zoom the field at San Diego in a demonstration of the latest equipment for dealing out death and destruction.



emergency plant, at Hog Island, was erected at a cost of \$50,000,000. From old and new runways alike, glided one steamer after another to sea, in rapid succession; for the national program required the launching of almost 2,000 boats, with an aggregate tonnage of 13,000,000. Even ruthless submarine campaigns could not destroy them as fast as they were turned out under the system of mass-production.

Once available for duty, vessels were loaded and dispatched as units in a single great Federal ocean transportation service. To prevent congestion at New York Harbor, freight was distributed among the leading seaports by the Railroad Administration, in accordance with the relative capacity of each for the efficient handling of cargoes. Filled with men and materials, steamers sailed for France on regular schedules, with train-like precision. Their position was known at all times, through radio and cable connections, so that their movement could be closely watched from a central office. At a number of French harbors, docks, hurriedly built by American engineers, were ready to receive soldiers and supplies. Through arrangements with foreign shipping authorities, the marine operations of the United States and the leading Allied powers were integrated on a world basis. By land and water, then, troops and equipment were moved from home and factory to the Western Front.

**Government Operation of Communication Nets.** Paralleling the unification of the transportation systems was the consolidation of the various agencies of communication. Previous to the outbreak of the war, radio licenses had been issued with the express understanding that stations might be taken over for full national operation upon the outbreak of hostilities. Consequently, it was a simple matter for the President of the United States to vest complete control of American radio facilities in the Navy Department—by a proclamation, in April, 1917. About a year later, the Post Office Department was appointed administrator for all private telephone and telegraph networks. Finally on

November 2, 1918, when it was momentarily expected that peace negotiations would crowd the lines with traffic, ocean cables were subjected to Federal supervision. At the close of the war every means for the electric transmission of intelligence, as well as the mail service, was in the hands of the Government. Advantage was taken of this condition to post official censors who devoted their efforts to preventing German spies from sending information or aliens from disseminating propaganda helpful to the enemy. To safeguard investors from losses, they were guaranteed proper compensation during the whole period of public management.

**Financing War.** Naturally such extensive government operations proved enormously expensive. As a means of meeting the cost, special taxes were placed on consumption, affecting theater admissions, for example. A substantial portion of the gains realized by individuals and corporations from war activities was also taken by the Government in the form of heavy levies on excess profits, incomes, and inheritances. "This," says E. R. A. Seligman, "is the high-water mark thus far reached in the history of taxation. Never before in the annals of civilization has an attempt been made to take as much as two-thirds of a man's income by taxation." The balance of the necessary revenue was obtained by borrowing—through the issuance of "Liberty Bonds" and minor obligations.

**Return of Industry to a Peace Basis.** Having gone to a vast deal of trouble and expense in putting the nation on a war footing, Federal authorities faced another hard task in restoring peace-time conditions following the Armistice. Transportation facilities were returned to their original owners as soon as emergency affairs could be wound up. As for the communication networks, their fate hung in the balance for quite a while. A few critics of private operation suggested that the unity achieved under central control during 1918 should be preserved permanently by placing the whole system in the hands of the Post Office Depart-

ment. But the advocates of individual initiative ultimately triumphed, all units being turned back to the former managing companies in due course.

Manufacturing plants, having remained in private hands from the beginning, could reach "normalcy" more rapidly, but naturally their contracts with the United States had to be settled in a satisfactory manner. In several cases goods were delivered in quantities to the Army after the Armistice was signed, to avoid breaking long-term agreements. In other instances, orders were canceled, the Government compensating the aggrieved parties. Industry in general was quickly released from the supervision of such emergency bodies as the War Industries Board. But even after all forms of political control had been terminated, business executives faced a challenging task in altering their equipment so as to manufacture peace-time commodities.

**Sales of War Surplus.** Expanded governmental enterprises had to undergo liquidation. When the Armistice was signed, American military and naval authorities were in possession of huge stocks of materials and machinery. As only a small fraction of this total was required for peace-time reserves, a long list of items was prepared for general sale, of which the following are typical: 76,877 trucks and trailers; 12,669 automobiles; 64,444 motorcycles and bicycles; \$70,000,000 worth of railroad equipment; 7,000,000 pairs of shoes; 5,750,000 blankets; 10,000,000 pieces of underwear; 1,000,000 shovels; 550,000 galvanized iron buckets; 1,870,000 shaving brushes; 100,000 mirrors; 3,000,000 cups; 148,000 wire cutters; 260,000 gas masks; 900,000 pounds of phenol; and \$1,270,000 worth of X-ray apparatus. In the aggregate, from \$4,000,000,000 to \$5,000,000,000 worth of new goods, together with a large amount of salvage, awaited disposal.

To prevent a demoralization of domestic markets, articles were released to the general public in small lots, as fast as they could be reasonably well absorbed. Merchandise was



auctioned off to jobbers who in turn retailed it to the ordinary buyer. As the goods purchased for military service were supposed to comply with rather rigid specifications, and as their ultimate price to the consumer was low, sale of these stores attracted widespread attention. Altogether the Government realized about a third on the original cost of its materials. The percentage recovered, of course, depended a great deal upon the nature of the items involved. Raw materials, such as chemicals, brought excellent prices, only twenty-five per cent being lost on them. Sets of uniforms, broken up into batches of shirts, hats, belts, and shoes, went over the counter by the hundreds for work clothes. Campers took delivery of tons of tents, collapsible cots, blankets, canned goods, and other field equipment. On the other hand artillery and ammunition had to be sold for four cents on the dollar, and airplanes for ten cents on the dollar. A lack of extensive industrial use for them, coupled with the expense of scrapping, was responsible for the slight figure. In such fashion was the cycle from peace conditions to a war footing and back again completed.

**Summary.** This review of concrete experience in the World War serves to emphasize anew the principle laid down at the opening of this chapter, namely, that technology has revolutionized the art of warfare and the social conditions connected with it. War is no longer waged by relatively small bodies of men sustained in the field by a few munition makers and supply industries. All able-bodied men of military age are involved. It is not the mere number of soldiers that turns the tide of battle. Everything may depend upon the destructive capacities of the engines and chemicals supplied to them. In the race for superiority in engines of war and materials, inventive ingenuities and laboratory facilities are worked at the highest tension. Owing to the interlocking character of technological industries, nearly all of them and their employees are drawn into the business of supplying machines and materials, so that the entire peace-

time economy is reconstructed for military purposes. In this way, peace-time social relations are disrupted, the distribution of wealth affected, and the authority of government made dictatorial. Since the close of the World War rapid strides have been taken in the direction of making the next war more technological, more destructive, more revolutionary in nature. If civilization is destroyed by war, as pacifists prophesy, then the main responsibility will rest, not upon generals in the field, but upon engineers in their laboratories and machine-shops. Thus a new aspect is given to the relations of technology and government.

## CHAPTER XI

### REVENUE-PRODUCING ENTERPRISES OF GOVERNMENT

When the whole area of modern technological operations is surveyed it is found that American governments, Federal, state, and local, own and operate a variety of revenue-producing enterprises. These undertakings include arsenals, shipyards, railways, street-car lines, water-works, electric light plants, bus lines, canals, ship lines, airports, heating plants, storage and refrigerating plants, terminal facilities, docks, forests, bridges, printing establishments, and miscellaneous manufacturing plants. Indeed, if all the enterprises operated under public auspices were assembled in one place they would constitute an industrial city of the first magnitude and represent a great many phases of modern industrial enterprise. This is one of the leading facts which the engineering student encounters in the study of government.

It is generally recognized, in principle, that Federal, state, and local authorities may properly provide highways, airways, aids to marine navigation, flood-control systems, sewage plants, and fire protection to the citizens free of charge. Since private parties in general are pleased to receive, but do not care to furnish, most of these services, there is little conflict of opinion with respect to such undertakings. Far different is the situation when political agencies begin to operate railroads, electric power houses, bus lines, and other profit-making enterprises. Businessmen naturally do not wish to lose customers to competitors in attractive fields. Inevitably, therefore, a contest has developed between industrial corporations and government over the extension of public ownership. Serving both sides in essential capacities,



engineers are irresistibly drawn into the struggle and are divided into contending factions over the issues at stake.

### HOW GOVERNMENT GETS INTO BUSINESS

#### **Government Enterprises Resulting from Emergencies.**

How did this rivalry originate? Why do political bodies sometimes organize profit-making or at least revenue-producing enterprises? Emergencies, for one thing, are responsible for such actions. For instance the World War created a heavy demand for the chemical ingredients of explosives and to supply a part of the requirements, a great Federal plant was built at Muscle Shoals, comprising a steam and hydro-electric generating apparatus and a factory for fixing nitrogen from the air with the power so provided. At the close of the war, with the emergency passed, national engineers found themselves with this equipment idle on their hands. Rather than let the system go completely to waste, the Federal Government sold electric power at the switchboard for some years. Finally in 1933, after a long period of study, Congress acted; the Tennessee Valley Authority was established, to take over the entire plant, construct new units, sell power, employ fixation equipment for manufacturing fertilizer, and erect transmission lines if desired. This heritage of the war is now the scene of vigorous public business activity. Out of the same military experience, the American merchant fleet (p. 365) largely grew. Having built an enormous tonnage of vessels to carry men and materials to France, the United States found itself with many carriers at its disposal on the cessation of hostilities. Unable to sell them on satisfactory terms and unwilling to allow them to rust and decay it entered the shipping trade, maintaining scheduled voyages with the best of the craft until opportunity was found to turn them over to private interests.

**Magnitude.** Occasionally it happens that the government is led into a public enterprise on account of the size of the

undertaking and the extent of the risk involved. Under this head may be cited the original Erie Canal and the Panama Canal. Great canals have been built entirely by private concerns, that at Suez, for example. But when the Erie project was proposed sufficient private capital was not available, so the credit and strength of the state of New York were employed. A similar situation occurred in the case of the Panama Canal, although, it must be added, there were political and strategic reasons why the Federal Government assumed the burden of construction and operation.

**Pressure of Particular Interests.** Very often private parties interested in an enterprise, as owners or users, bring pressure to bear on government to induce it to embark upon a public undertaking, generally under some slogan of public policy. In the case of the transportation system of New York City, private operating companies learned from years of bitter experience that they could not earn satisfactory returns, if any, on their stocks and were in constant peril of default on their bonds; hence they welcomed a proposal for turning the entire rapid transit system over to the City; little or nothing except differences over the terms has prevented a consummation of the project. Shippers of grain and other commodities in the Mississippi Valley were partly responsible for government operation of barges on that waterway; and they are behind the project for the great St. Lawrence waterway, now under consideration as a public enterprise.

**The Inefficiency of Private Management.** In the case of forestry the wastefulness and negligence which accompanied private exploitation of timber resources, in a large measure, account for government enterprise in this field. When the white man first came to America, it is estimated, there were 900,000,000 acres of timber in the continental United States. This enormous wealth has been attacked with reckless abandon. We use approximately two-fifths of all the wood cut annually in the world—half the manufactured lumber

and over half the paper. In another form, the total annual per capita consumption of our nation is 228 cubic feet, compared with 129 in Sweden, 66 in Russia, 27 in Germany, 26 in France, 15 in Italy, 15 in Great Britain and Ireland, and 9 in Spain. In addition to the material actually put in service, there has been a great deal of waste due to sawing trees too far above the ground, felling them in such a manner as to break and splinter the stems, or permitting pests and flames to ravage huge districts. Altogether 22,406,000,000 cubic feet are cut yearly, 1,080,000,000 are charred by fire and 1,300,000,000 attacked by insects. When considered with respect to growth, these statistics are appalling, for it is calculated that we are chopping down forests four times as fast as they are being replaced by nature. By 1920 the process had gone so far that only half the normal coverage remained and most of that was second growth. Besides promising a timber shortage in the future, depletion of this resource materially diminishes the water storage capacity of the soil, promoting costly erosion and floods. In short, the exploitation under individual control is far from rational, given the requirements of American economy.

Moreover, there is little incentive for private parties to replant forests to obtain a continuous yield, owing to the long period of time required for trees to reach maturity. White pine requires from 25 to 35 years to attain a size suitable for fence-posts; 35 to 45 years for pulp and fuel; 50-60 for railroad ties; 65-75 for poles and piling; and 90-100 years for saw-logs. The ordinary citizen, when he cuts timber, is not likely to bother about planting a crop that will not be ready to harvest for another century. Nature, then, conspires against individual enterprise in this field. But governments, representing generations yet unborn, as well as the present, and expecting to enjoy an indefinite existence, are in a position to exercise foresight and proper care. Regarding the destruction of our timber supply with alarm, they have undertaken to establish a series of national and state



reservations to meet the peculiar condition in this branch of economy. These forests are frequently managed on a continuous-yield basis, the output being sold commercially.

**Retaining Water Resources.** For a long time it was the policy of state and Federal governments to sell outright to private concerns power sites along rivers, especially on the public domains. Early in the twentieth century, that policy was abandoned by the Federal Government; power sites under its jurisdiction were reserved from outright sale; and under the Water Power Act of 1920 a policy of leasing was substituted for that of sale. Then a demand was heard in Congress that the Federal Government should itself develop important power sites. This demand culminated, in the case of the Hoover Dam project, in the construction of the dam by government agencies and the leasing of falling water only. This was a compromise between advocates of public ownership and private enterprise. The same movement in thought led finally, after a long conflict in Congress, to government *operation* of the Muscle Shoals plant (above, p. 357) and to a provision of law authorizing the Government to construct even transmission lines for the delivery of power, if satisfactory arrangements could not be made with private enterprise. In some states, notably New York, a similar policy has been laid down recently.

**Cutting the Cost of Government Supplies.** As major buyers of commodities, American governments, if efficient, must watch their outlays for supplies. Where bids are too high or limited funds hamper purchasing at standard prices, they sometimes attempt to manufacture goods themselves. Hence there have grown up a number of government establishments for the manufacture of supplies and the repair of machinery. Mention has already been made of the savings effected in arms and munition outlays through the operation of Federal arsenals (p. 271). To cite another example, the City of Milwaukee, in 1930, constructed two four-wheel

drive hook and ladder trucks and completed two pumps for its fire department, rather than purchase the equipment in the open market. Government industries connected with the manufacture of supplies are also employed sometimes in checking the costs and prices of private concerns offering goods at public biddings.

**Experimental Business Agencies.** Believing that specific pioneer projects have merit but finding private capital reluctant to undertake them for fear that profits will not be forthcoming, political bodies may initiate business ventures on an experimental basis. Eventually, it is hoped, in such cases, that the example thus set will attract private parties and capital into the field, and that when the original purpose has been fulfilled, the government may sell out and retire. A case in point is that of the Inland Waterways Corporation. Despite the fact that the United States had poured millions of dollars into river improvements on the Mississippi and tributaries, shipping on that great waterway remained small in volume. Speaking of one portion of the system, President Harding said, in 1923: "It is a very discouraging picture to contemplate the expenditure of \$50,000,000 of public funds on an inland waterway when the tonnage on that waterway has diminished more than half, while the waterway itself is made better year by year. We have either wasted many hundreds of millions in blind folly or have been inexcusably remiss in turning our expenditures to practical account." Convinced that the latter explanation was correct, Congress established a barge line on the Mississippi to demonstrate the commercial possibilities of such service for the enlightenment of skeptical men of affairs unwilling to risk their capital.

**Quest for Lower Utility Rates.** Citizens seeking lower water, gas, or electric rates or better service, generally have the right to appeal for relief to a public-utility commission or other body (below, Chapter XIII). But the process may be so slow and complicated, owing to legal and accounting

difficulties, and the final decision may be so unfavorable to the consumer that considerable popular discontent will arise. Where the dissatisfaction is very strong, voters may abandon the struggle for reduction by regulation and try the alternative of public enterprise. When plans are laid for a municipal electric plant, for example, the voters expect to control the management in the public interest and to get reduced rates immediately. Not only is it usually hoped that costs will be cut for those actually using the public current, but it is also hoped that competition from the government plant will force private concerns operating in the same area to lower rates in self-defense. Government ownership of utilities is a kind of barometer by which the discontent of large masses in urban centers with private utility management can be roughly measured.

**Rehabilitating Prisoners.** Problems in penology are responsible for the entry of government into a variety of manufacturing ventures. Experience has taught that men confined to jail with absolutely nothing to do grow restless and deteriorate in fiber. Consequently some prison industries were started as a means of improving their morale, although the exploitation of prison labor by private contractors was also a powerful motive in this development. But better discipline is only one of several goals. Practice on modern machinery, supplemented with formal class instruction, provides convicts with vocational training. It is hoped that such new knowledge may enable them to make an honest living after their release. Public authorities also benefit from prison industries, for the finished chairs, shoes, bedding, and metal ware may be turned over to state hospitals, soldiers' homes, and other institutions, thus cutting expenses for supplies. As an alternative, the goods may be sold on the open market, \$17,000,000 worth being disposed of in this manner in 1932. In either case, prisoners help to pay their way, relieving the load on the treasury. This lightening of burdens is no small item, for in 1932 products



resulting from Federal and state penitentiary operations were valued at approximately \$75,000,000.

**Upshot.** From the above survey it is evident that the question whether a government should or should not construct, own, and operate a given enterprise does not turn entirely on the issue of engineering rationality and efficiency. On the contrary the factor of pure efficiency is seldom the decisive factor in a particular case. Nor do we find private interests lined up against "the public" in every case. Indeed they often appear as advocates of public ownership and operation. Hence engineers will be on their guard against assuming that the theoretical arguments on this subject, which appear in public discussions and academic treatises, are the controlling considerations in determining any specific question of public ownership one way or another.

#### GOVERNMENT BUSINESS ENTERPRISES DESCRIBED

**Railroads and Buses.** For a variety of reasons, the several units of American government have embarked on a striking number of what are distinctly business enterprises. Our survey may start with agencies devoted to transportation. Beginning with land facilities, we find public bodies managing railways. Two major steam lines are run by Federal authorities. One, in Alaska, was built to develop the rich interior region. Completed in 1923, it comprises 467 miles of track, costing approximately \$60,000,000. The other serves as an adjunct to the Panama Canal, paralleling that great waterway across the Isthmus. As for street-car routes, there were 794 miles of municipally operated trolleys in the United States in 1932. The leading systems were located in Detroit, Seattle, and San Francisco. A few cities also provide bus service, among them being New York, which operates several commercial routes.

**Bridges and Tunnels.** Serving as additional transportation facilities are government bridges and tunnels, made especially necessary by the advent of heavy modern auto-

motive traffic, and managed on a business footing. Owing to the monstrous size of some undertakings in this field and their locations, the entire burden has not been placed on the local taxpayer, particularly since the chief benefits are often derived by commuters or through-travelers. Instead, toll charges are generally levied on all who pass over the structures, the collections sometimes ceasing when the original cost has been completely covered out of earnings. On the first of August, 1930, there were sixty-two government toll projects, representing an investment of \$120,000,-000. In 1933 the mightiest of them all was placed in operation—the George Washington suspension bridge across the Hudson River, linking New York, and New Jersey. Its clear span of 3,500 feet is the longest in the world. One deck, now open, is capable of handling eight lanes of vehicles, while provision has been made for the addition of a lower deck, to hold four rapid transit lines.

**Airports.** American communities are seeking air traffic today, just as they tried to obtain rail connections in years gone by. With a view to attracting passing craft, a number of cities and counties have built well-equipped airports. So strong was the movement that by 1930 there were 543 municipal fields in operation as compared with 495 in private hands. These government facilities are handled on a commercial basis. Hangars are rented, gas sold, and the usual sources of income tapped. Certain of these business enterprises are extensive, over a million dollars apiece having been invested in some fields. Cleveland, Ohio, possesses one of the major units—a thousand acre tract on which it is said that eighty planes can land simultaneously. Parking space for 20,000 automobiles is provided, the reservation being a favorite spot for mere spectators. And for night illumination, flood-lights of 500,000,000 candlepower may be turned on the runways.

**Ship Lines.** American governments operate a number of marine facilities on a business basis. Attention may be

drawn to the fact that Federal Army officers run a barge line under the trade name of the Inland Waterways Corporation. This unit was established, as pointed out above, as an experiment to demonstrate the usefulness of the expensive system of public river improvements. In 1932 it maintained a year-around schedule from New Orleans to St. Louis, Missouri, on the Mississippi River. During favorable weather, a connecting link carried goods between St. Louis, St. Paul, and Peoria. To the East, a branch extended from New Orleans to Birmingport, a harbor on the Warrior River for the important coal and iron section surrounding Birmingham, Alabama. In 1933 the first tow reached the Great Lakes from New Orleans, signaling the completion of a new channel from Chicago to the Gulf. Altogether the Corporation owns 350 pieces of floating equipment, consisting of steel barges and the necessary towing craft. Also on the ledger is a considerable investment in terminal equipment. A 1932 survey placed a valuation of \$7,000,000 on the entire plant. Of minor importance as marine lines are the municipal ferries, such as those owned by New York City, which are engaged in regular commercial traffic.

On the high seas the United States Department of Commerce, a Federal organization, manages a fleet of vessels originally built for World War purposes (p. 357). At the close of hostilities, the tonnage was large, and a series of lines was established, touching at foreign ports. But as fast as these pioneering ventures proved successful, they were either sold or leased to private companies. The result has been that the Government has steadily withdrawn from the business, as profit-making opportunities appeared. As the law now stands, eventually the operations of the unit are to cease entirely. In 1930, however, the Government was still managing over 150 active cargo craft, making hundreds of voyages, at a loss to the national treasury of \$10,000,000 a year. Held at anchor were 270 more ships, awaiting scrapping.



**Panama Canal.** Canals, as pointed out below (p. 388), generally furnish free services. But the famous Panama Canal, extending across the Isthmus of the same name, is an exception. The total length of this route, from ocean to ocean, is 40 miles, ships traversing three sets of locks, two lakes, and a deep cut. Original construction costs totaled some \$300,000,000. Tolls are charged vessels using the system, the fees being willingly paid on account of the compensatory saving in fuel resulting from the shortened passage. Owing to the Canal the water journey between New York and San Francisco is reduced by 7,800 miles, and between New York and Yokohama, Japan, by 3,300 miles. In 1929 Canal receipts amounted to \$27,000,000. Besides the waterway itself, the Canal management operates auxiliary coaling and oiling stations, dockyards, electric plants, stores, and other facilities essential to making the establishment self-sufficient.

**Municipal Harbors.** Several seacoast cities have experimented with the municipal ownership of harbor and docking facilities as business ventures. Millions of dollars are now invested in such undertakings—Baltimore having spent \$22,000,000; Portland \$40,000,000; and Oakland \$10,000,000. A description of any one of them reveals an extensive array of official activities. For example, the Portland, Oregon, government port is equipped with four terminals, open to all boats on equal terms. The pier frontage totals about a mile. The wharves are supplied with sheds, rail connections, loading machinery; even a 1,000,000-bushel fireproof grain elevator is available. To provide repairs for visiting ships, a central yard is maintained. Here are to be found two floating drydocks, one of 10,000 tons capacity and the other of 15,000 tons. No private company in the vicinity is nearly as well supplied with machinery. Taken collectively, political bodies have heavy stakes in the transportation field—by land, water, and air.

**Post Office System.** Ranking as the leading government business enterprise in the communication field is the Fed-

eral Post Office Department. For the year ended June 30, 1930, its receipts and expenditures amounted to \$705,000,000 and \$804,000,000 respectively and at that time it had 300,000 employees. In discharging its functions it operates a complicated equipment of buildings, trucks, sorting and canceling machines, and other property. The major function of the service is to carry letters and papers. Under the Constitution, as interpreted by the courts, the United States has a monopoly of letter carriage, private parties being wholly excluded from competing.

However, the Post Office Department will not accept every type of message for transmission. On the contrary, as a public guardian of morals, it is bound by law to regard certain matter as unfit for the mails. In the rejected class are obscene photographs and writings; notices relative to lotteries; advertisements and circulars employed in extracting money from the gullible for worthless oil stock, "electric rejuvenators," and the like; and all information dealing with methods for birth control. A squad of inspectors is kept on the trail of persons sending prohibited items by mail.

Opening the extensive facilities of the Post Office Department to the ordinary shipper, Congress has provided for the transmission of parcels of limited size between all points covered by the letter service. But Federal authorities do not possess a monopoly over the carriage of packages. On the contrary, express companies continue to exploit the same field, their revenues reaching the striking total of \$200,000,000 in 1931. Naturally private concerns suffer a considerable loss in business as a direct result of government competition, and are often hostile to the parcel-post system. Entering the banking business, too, the government offers to transmit money for a small fee, through the issuance of money-orders. Nor is this all. Post offices receive small deposits of cash, managing savings accounts that draw a low rate of interest. Since these facilities are open to every citizen, private financial concerns feel the pressure of such competition.

The process of actually handling the letters and parcels begins in cities with collections by uniformed messengers. In the country, mail matter is picked up by rural free delivery agents who render a very extensive service, traveling over 400,000,000 miles annually. On the ocean a number of sea-post stations are maintained aboard regular liners, partly for sorting purposes and partly to receive mail from passengers aboard ship. Moreover a large volume of mail is presented directly to railway cars and to the 50,000 Federal post offices. After checking and cancellation, mail is conveyed to its destination by rail, by air, by boat, or by motor vehicle. Under an international agreement, mail passing to and from the United States is supervised by agents of the Universal Postal Union, and transmitted over the shortest routes, for the least practicable fee, throughout most of the civilized world. Periodic cash settlements among member powers equalize the burden of expense. At the points of destination letters, papers, and parcels are delivered either at post offices, or by delivery employees, to the addressees; and if the directions on envelopes and wrappers are inadequate special efforts are made to locate the proper persons. If necessary, city directories, telephone books, and other sources of information are utilized in the search. Papers and goods for which claimants cannot be found are shipped to the dead letter office where an attempt is made to restore them to the original senders. If no clues are forthcoming, then the material is either destroyed or sold at auction, approximately \$100,000 a year being realized from salvage sales.

**Electric Communication Nets.** Also serving as agencies of communication are two major radio systems operated by Federal departments. One is in the hands of the Navy, connecting various bases in the United States with points in outlying possessions. The other is run by the Army, performing a similar duty. For example, a series of transmitting and receiving stations has been established in Alaska and



is joined to the state of Washington by way of a military cable down the Pacific Coast. This equipment was installed primarily to provide rapid means for conveying orders in time of war, rather than for revenue purposes. In many places, private companies find traffic so slight as to make it unprofitable for them to duplicate government channels. A number of localities are thus left with no other means of swift communication than those offered by the national authorities. Consequently Federal law provides that anyone may dispatch messages over either the Navy or the Army net upon the payment of the scheduled charges. If, however, commercial service to the same districts becomes adequate, the Government voluntarily agrees to cease competing. There can be, then, no legitimate objection on the part of private enterprise to the arrangement. Similarly, the Coast Guard has built telephone lines along the seaboard as a means of signaling life-saving stations for help in case of need. A certain amount of private business is allowed to flow over this route. Finally a few small towns have municipal telephone plants, furnishing services on a regular public-utility basis.

**Water-Supplies.** In no line of local public-utility activity is government more strongly intrenched than in that of water-supply. Municipal ownership in this field has grown with astonishing rapidity until, of the 250 major cities possessing 30,000 or more inhabitants in 1927, all but 40 operated the local works. A desire for the utmost security in protection against fire and pollution is partly responsible for the trend from private to public enterprise.

Paralleling the growth in the number of municipal works is an increase in their size and complexity. Several developments account for the change. Naturally the increase in the population of the leading industrial centers adds new customers to the list. But per capita consumption has also gone upward, as a result of rising standards of life, the installation of additional sanitary fixtures, and the heavy demands of

new factories. On top of the necessity for greater volume, comes the pressure, led by modern science, for freedom from pollution. Consequently cities have been compelled either to go further and further into rural regions to find the requisite clean flow, or to establish expensive purification plants to treat tremendous flowage from nearby rivers and lakes. The whole trend has been towards more and more elaborate projects.

Among the largest municipal works is that of New York City. A total of \$367,000,000 or more than the construction cost of the Panama Canal is invested in this system. Catering to the needs of 6,000,000 people, it brought in a revenue of \$25,000,000 during 1930. Twenty-four reservoirs, with a combined surface area of 37 square miles, and a capacity of 285,000,000,000 gallons impound the requisite rainfall. Linking them with a terminus on Staten Island is a main aqueduct, 120 miles long. This route passes under the Hudson River at a depth of 1,114 feet below mean sea level. On reaching Manhattan, it runs through solid rock, 200 to 750 feet beneath the streets, providing pressure sufficient to force water high up into the skyscrapers for which the region is famous. When the Colorado River aqueduct project for the Metropolitan Water District of Southern California is completed, the West will have a comparable plant. The proposed aqueduct is to be 260 miles long, diverting Colorado River flowage into Los Angeles and surrounding territory. Already a bond issue of \$220,000,000 has been authorized for the scheme.

**Electric Light and Power.** Of more recent origin are official ventures into the electric light and power business. As pointed out before, such undertakings are frequently initiated during a conflict with private utilities, with a view to forcing a reduction in rates. Measured by the number of plants in service, municipal ownership is impressive; for, in 1932, 1,802 systems were owned and operated by cities—a majority of all those in the United States. But on the basis of



*Photograph by Brown Brothers*

### THE GOVERNMENT IN THE TOLL-BRIDGE BUSINESS

The George Washington bridge, built at a cost of \$60,000,000 and operated by the Port of New York Authority (see p. 364).





*Courtesy of the Department of Lighting, Seattle, Washington*

#### MUNICIPAL OWNERSHIP IN THE ELECTRIC FIELD

The Gorge Power House of the municipally owned and operated electric system of Seattle, Washington. Capacity, in 1931, 75,000 horsepower (*see opposite page*).

output, the story is very different. Since a great many of the works are of small size, municipal plants account for only about five per cent of the current generated.

However there are a few major government projects that deserve individual mention. Outstanding among these is the extensive Federal hydro-electric system being created by the Tennessee Valley Authority at Muscle Shoals and vicinity under legislation enacted in 1933. A second famous enterprise is at Hoover Dam. At the latter point Federal authorities are supervising the installation, under lease, of fifteen generating units of 82,500 kilovolt amperes capacity apiece, and two of 40,000 each, a combination capable of furnishing 660,000 continuous horsepower of electric energy. Existing arrangements provide that the City of Los Angeles, together with the Southern California Edison Company, shall jointly maintain the plant. The current thus made available will be divided between public authorities and private groups in certain proportions; of the assignment to California, the municipal system of Los Angeles will receive thirteen per cent, the Metropolitan Water District of Southern California thirty-six per cent, and other Southern California cities six per cent, of the total electric output. Of similar magnitude are plans for developing current at one or more dams along the proposed Saint Lawrence Seaway from the Great Lakes to the Atlantic. An enabling treaty is now in abeyance, with ultimate settlement as to public or private ownership still farther away. Among the great municipal systems must be reckoned that of Los Angeles which delivers 140,000 horsepower, from several works placed along the Owens Valley Aqueduct, to thousands of customers in the Los Angeles area.

In the super-power field little has been undertaken by governments, owing to the small size and wide distribution of the majority of municipal plants. However there is one net, in the Pacific Northwest. Both Seattle and Tacoma, Washington, own their electric systems. In order that they

may pool their current, a forty-mile transmission line has been put in service, making a single operating unit out of the two establishments.

**Gas Works.** Municipal ownership is also to be encountered in the gas industry. In 1923 there were 110 city systems in the United States, fifty-four of them handling artificial, thirteen natural, nine acetylene, and fifteen, other types of gas. The combined receipts from such government works amounted to \$7,000,000 in 1929. Omaha, Nebraska, possesses the largest public plant in the country, having bought it from a private company for \$4,580,000 and put it in operation in 1920. This undertaking supplies 200,000 people with 1,400,000,000 cubic feet a year. In most cases municipalities manufacture and deliver gas, rendering a complete service. Sometimes, however, they purchase it from commercial sources and merely take charge of distribution. Duluth, Minnesota, for example, obtains its supply from a smelting and coke oven enterprise that would otherwise let it go to waste. So, too, a few municipalities secure natural gas from private owners or pipe-line concerns.

**Central Heating Systems.** Occasionally cities run central heating systems for the benefit of private customers. Among them may be listed Newton, Massachusetts; Bloomington, Indiana; and Brookings, South Dakota. Such installations supply steam, through mains laid under the streets, to buildings located within a considerable radius of the municipal boilers. Apartments, offices, stores, and homes are thus freed from the burden of having to operate individual furnaces. An economical arrangement occurs where the exhaust from municipal power houses is discharged directly into delivery pipes. Sabetha, Kansas, a town of 1,800, and Cleveland, Ohio, provide service from their light plants in this fashion.

**Ice Plants.** Outside of the public-utility field are to be found a number of government factories for the production of articles of trade. For example, cities have occasionally



installed equipment for the manufacture of ice. In embarking on this venture, they have frequently encountered legal difficulties. Ruston, Louisiana, was ordered by the courts to end its ice-making operations on the ground that it competed unfairly with local concerns exploiting the same field. Lewiston, Maine, went so far as to construct a large plant and completely stock it with ice before the judiciary called a halt. Similarly, Schenectady and Mount Vernon, New York, were required to withdraw from the business. But the trend has not been entirely against the municipalities, for Weatherford, Oklahoma, finished its refrigerating works in 1913 as an adjunct to its power house, and sold the output for a long time on the open market. Omaha, Nebraska, succeeded in getting its apparatus into lawful operation in 1918. However the importance of this line of municipal enterprise is declining as electric devices tend to replace central ice plants.

**Printing.** Public authorities operate a few publishing establishments, more or less on a business basis. Most important of all is the Government Printing Office, at Washington, D. C., run as a Federal establishment. In fact it is the largest single undertaking of the kind in the entire world. It turns out books, often to be sold at cost, on an amazing variety of subjects. A number of its offerings are of such a character as to compete with those available through private channels, arousing considerable opposition in regular trade circles. A second major governmental printing establishment is that owned and operated by the state of Kansas. This plant turns out texts on a variety of subjects for general sale to schools in competition with the supplies available from private sources. Thus in 1917 it offered a line of twenty-four books and sold \$670,000 worth between July 1st and October 1st, the regular purchasing season for the ensuing academic year. Commercial publishers are generally opposed to such schemes, and occasionally align themselves against official undertakings by refusing to grant them copyright privileges on leading works.

**Mills.** North Dakota is situated in the heart of a great grain-growing belt. Responding to the pleas of farmers for some local means of processing their crops, the state built two government mills. One plant, at Drake, is of an experimental nature and therefore small in size. The other, at Grand Forks, is engaged in extensive commercial operations. Although hampered by legal and political difficulties, both have been kept going for years.

**Pasteurization of Milk.** Feeling that the community deserved better protection against impure milk, Tarboro, North Carolina, installed a pasteurizing equipment. Ordinances were adopted granting a public concern a monopoly by forbidding the sale of any milk that had not passed through its plant. Buying daily supplies from private dairymen, the town sterilized, bottled, and delivered the milk to residents as a complete government service. The mayor of Jamestown, New York, has proposed a similar system for that city.

**Government Supplies.** Federal plants manufacture a variety of articles useful for military purposes. Thus the United States Navy runs several shipyards where war vessels may be constructed. Government plants also produce guns, powder, torpedoes, binoculars, anchor chains, rope, cans, drums, paint, varnish, polish, furniture, mattresses, hammocks, propellers, mess tables, lockers, Diesel engines, gasoline engines, and fire extinguishers for the fleet. For the land forces, the Army makes uniforms, harness, guns, and ammunition at its own special establishments.

Miscellaneous Federal manufactures include a variety of essential supplies. Among them are ink, paste, mucilage, and blank books, turned out for national agencies by the Government Printing Office. For its detailed computing work, the Census Bureau constructs and repairs its own special calculating machines. Finally many items are produced in Federal, state, and local prisons, such as shoes,

brushes, cotton cloth, tents, mail sacks, automobile tags, and furniture.

**Federal Forests.** Seeking to preserve a substantial portion of our timber resources from extravagant exploitation, a number of units of American government have entered the forestry field, in competition with private operators. The greatest acreage is in Federal hands, totaling 150,000 square miles, or slightly in excess of the area of our third largest state, Montana. This has come about naturally. In heavily wooded regions state authorities are often at the mercy of powerful lumber concerns, and therefore unable to establish local reservations. But the Federal Government, which still holds large areas of its original forest domain and enjoys the support of Eastern consumers, is in a strategic position for practicing conservation, and has the strength necessary to invade almost any section.

At first Federal forest reserves were carved out of the original public domain—costing nothing to acquire. But while the United States owned great areas of land in the West, it held little in the East. Consequently, its system of reservations was rapidly becoming geographically unbalanced. After a prolonged search for means of escape from this situation, a remarkable act was passed. According to constitutional lawyers, navigable streams are subject to congressional control and the Federal Government can take any steps necessary to improve them. Now tree coverage helps to store rainfall, letting it out gradually into nearby watercourses. Thus alternate floods and droughts are reduced in intensity and a more even flow results. So the nation, it was held, is amply justified in buying tracts from private parties, to be used for growing timber as a means of protecting the navigable streams subject to its supervision. By an act passed in 1911 Congress therefore authorized purchases of this nature. Under that measure, later widened to include the clear-cut purchase of land for timber production, extensive regions were acquired in Florida, Ala-



bama, Georgia, South Carolina, North Carolina, Tennessee, West Virginia, Virginia, Pennsylvania, New Hampshire, and Maine.

**State and Local Forests.** Following national policies, several states have also acquired extensive tracts of woodland—some serving as parks and others being available for the production of commercial timber. The underlying motive is not merely to save trees but also to put to use marginal lands that seem to be unfit for agriculture and would otherwise lie waste. In the aggregate, these holdings total 10,500,000 acres. The largest of all is in New York, where some 2,000,000 acres have been set aside in the Adirondack and Catskill Mountains. Further reservations of importance are: in Pennsylvania, 1,000,000 acres; in Washington, 1,200,000; in Idaho, 700,000; in Montana, 556,000; in Minnesota, 350,000; in Michigan, 333,000. Projects are in operation in twenty-two out of forty-eight states.

Not to be outdone by larger units, several counties and cities have set aside tracts for the production of timber. Altogether these local ventures include approximately 700,000 acres. In Massachusetts, for example, seventy-eight cities and towns have established wooded reservations, comprising about 10,000 acres in the aggregate; while in Vermont thirty-eight towns own a total of 8,000 acres. Clearly governments have gone into the forestry business on an imposing scale.

**Forest Management.** Where the prime purpose of a government reservation is to raise timber on a commercial scale, trees are marked as soon as they reach maturity. Generally the timber is sold as it stands, private companies being required to furnish their own facilities for cutting and hauling the material to the mills. Such undertakings are extensive, as the figures for 1930 indicate. In that year a total output of 3,370,417,000 board feet was sold to concerns working in the national forests, the United States deriving the substantial revenue of \$4,400,000 from the enter-

prise. To prevent waste, officers closely supervise the process. Usually care is taken to administer services on a continuous crop basis. Thus, cutting is done in such a manner as to clear space for young stock, so that it may grow up to replace timber removed.

Where nature cannot repair the havoc wrought by fire and axe, direct replanting must be undertaken. Consequently a number of Federal and state nurseries are maintained for producing the requisite supply of seedlings. No little criticism has been directed to the replanting phase of the operating cycle on the ground that it lags far behind present needs. In other words, public agencies are sometimes as remiss as the ordinary citizen in maintaining steady yields, with corresponding losses from the standpoint of efficient forestry. But in 1933 a forward step was taken by the formation of the Federal Civilian Conservation Corps of 300,000 hitherto idle men to replant marginal land and barren wastes.

Naturally the wood sold by government administrators enters the open market in competition with that sawed on private lands, inducing the owners of forests to bring pressure to bear on public agencies with a view to compelling them to limit their output. Hence trees in public forests are not cut down as rapidly as they reach maturity, and many are allowed to rot where they stand. The national reservations alone could increase their present production sixfold, by merely taking steps to see that no ripe timber goes to waste; but they are not permitted to operate at full capacity. Is this policy of restraint wise, from the point of view of general welfare? With respect to engineering efficiency the answer is in the negative. Efficiency would require the operation of public forests at full capacity, especially since the consumption of timber in the United States exceeds the natural growth. The result would be, however, to slow down the rate at which private concerns are exploiting their holdings.

Whatever disposal may be made of mature trees, growing stock must be protected against its natural enemies. Forests usually contain thick layers of leaves and other débris which, during dry seasons, will burn with sufficient intensity to ignite green trunks. No end of havoc would be wrought in the process if the ingenuity of man were not brought into play. To combat the peril, miles of cleared passages have been cut through government timber reserves, presenting barriers which flames find it hard to leap. On prominent points lookout stations are maintained where rangers keep a constant watch for the first signs of trouble. As soon as smoke is detected, patrol headquarters are notified and men and equipment rush to the scene to do battle with the conflagration. Despite an annual expenditure of more than a million dollars for fire control, and vigorous efforts to hold down losses, 7,000 fires broke out in national forests in the period from 1922 to 1926, causing \$1,500,000 worth of damage. Slower but equally disastrous inroads from insect and fungous pests must also be held in check.

Government forest administration involves the supervision of grazing. Except in areas where very young trees are growing, livestock can safely be allowed to roam at will, foraging for their food and the Federal Government lets some of its forest lands to farmers and grazers, granting them the privilege of turning in their herds at a fixed rental. Thus in the season of 1926, 7,500,000 domestic animals grazed in the national reservations and there was room for more. In fact it has been claimed that these tracts could support one-third of all the cattle in the Western range states.

**Mineral Lands.** On certain portions of the public domain are to be found other vital resources besides timber. For a long time mineral tracts were sold to private parties at low rates under various stone and mineral Acts. But after having disposed of the bulk of its deposits in this fashion, the United States Government called an abrupt halt. Its domains were then classified according to their intrinsic nature,



more valuable sections were reserved from general sale, and the practice of leasing mineral lands was adopted. Private operators wishing to exploit ore veins or tap oil pockets in such districts could only do so henceforth by acquiring leases in due form and by paying suitable royalties into the national treasury for the privilege.

On the first of October, 1928, there were 29,883,366 acres of Federal land formally classified as coal-bearing. Private parties wishing to exploit these coal resources must now begin by obtaining a prospecting permit. After the successful location of suitable veins, a second license is issued to the prospectors allowing them to mine the new beds as long as they pay the stipulated royalties. For the year ended June 30, 1928, the Government received \$373,000 as compensation for 3,000,000 tons of coal so extracted. Parallel policies have been followed with respect to public oil and gas fields. So far, approximately 5,000,000 acres have been labeled as petroliferous. From leases in these fields national authorities derived about \$50,000,000 in revenue between 1920 and 1928, in addition to \$20,000,000 secured from the sale of flowage rights on naval reserve basins. Numerous other minerals under Federal jurisdiction are dealt with in an identical manner. A few states also possess mineral tracts which are rented to operating companies on a like basis.

**Irrigation Works.** Among the major business enterprises operated by governments must be included irrigation works. By 1920, \$88,600,000 had been invested in such establishments by irrigation districts, and they were providing 1,820,000 acres with water. Each irrigation district is a distinct entity, with boundaries adapted to the topography of local watersheds. It usually possesses the right to condemn land, to construct reservoirs, canals, and appurtenances, and, theoretically, to charge residents rentals sufficient to meet all costs. In some cases expenses are covered by levying definite assessments on settlers. An alternative

scheme is to apportion bills on the basis of the quantity of water consumed on individual farms and ranches. As a safeguard, payments may be demanded in advance, an official being sent to admit the flow stipulated in the contract and duly paid for. Here, then, is an arrangement bearing many points of similarity to that adopted in the case of water-works for cities.

A comprehensive system of widely scattered developments is managed by the Federal Government. Its units irrigate a total of a million and a half acres, located in fifteen states. Altogether approximately \$140,000,000 has been invested in the necessary engineering features. Prominent among the latter are the storage reservoirs which, on the 30th of June, 1928, were capable of holding a quantity of water sufficient to cover Maryland to a depth of two feet. The combined volume of material in Federal dams is six times as great as that composing the Great Pyramid of Cheops, in Egypt. And the combined length of canals and drains would stretch across the continent five times.

To finance these Federal enterprises, Congress has set aside revenues derived from the sale of certain public lands, from royalties on oil and gas leases, and from a few miscellaneous sources. The capital so secured is used to meet the construction costs of new projects. After each is completed and placed in operation, settlers on the irrigated lands are required to reimburse the Government, in periodic installments, for its original outlay for dams, canals, and appurtenances. Money so returned by farmers is immediately available for the building of additional systems. Terms are lenient, for residents do not have to pay any interest on the investment. To meet running expenses, occupants are charged a rental based on the quantity of water they consume on their respective ranches.

Farming procedure on irrigation projects is unique. The settler has to be constantly on guard to make sure that he is supplying exactly the right amount of water to his crops. If

excess water is admitted, plants are drowned; if too little is employed, they wither. But certain inherent advantages in the process amply compensate him for his trouble. For example there are few clouds and almost no fog to obscure the sun in naturally arid sections, so an extraordinary quantity of heat and light beats on the surface, encouraging abundant growth. In fact, properly managed ranches may produce two, three, or even four harvests in a single year. Secondly, soil in the desert is often rich, for valuable chemical deposits have not been exhausted by previous vegetation nor leached away by intermittent rains. However, in their travel from distant sources, life-giving streams may pick up considerable quantities of alkali. As the heavily charged water spreads out over the ground, salts occasionally separate in sufficient proportions to render the earth wholly unfit for cultivation. A large acreage has already been abandoned for this very reason.

### THE RESULTS OF GOVERNMENT ENTERPRISES

**Yard-Sticks for Measurement.** When examining the operations of business enterprises, such as have been already described, and the public discussions which accompany them, the student of engineering is immediately impressed by the confusion of opinion and the absence of fixed standards for measuring the results of government undertakings and passing judgment on their "success" or "failure." In an engineering project, the supreme and inescapable test is whether it delivers efficiently the quantity of water, power, or commodities for the exact service for which it was designed. Here there is not much room for dispute, and the same test can be applied, within limits, to the engineering works of government. Indeed, a good administrative officer does periodically apply them to plants under his jurisdiction. But other considerations enter into government undertakings. As already indicated, they are frequently established for reasons other than the efficient accomplishment of ends,



or the provision of a return to the government comparable to the profits of private concerns.

**Profits from Government Enterprises.** Nevertheless, it is habitual to apply the profit-making standard to government undertakings and to ask whether they are making enough money to yield a satisfactory return over and above all outlays including capital charges, depreciation, running expenses, and other legitimate disbursements. Several examples of public enterprises deemed successful under this rule may be cited. One example is the municipal electric works in Pasadena, California, which has not only met all expenses for many years but has built up a surplus out of which a total of \$825,000 has been borrowed to construct a municipal golf course, a civic auditorium, and a hall of justice. The small town of Colby, Kansas, has succeeded in paying the entire expense of local government out of the returns from her municipal water-works, obviating taxes. A study made in 1927 by a group of engineers shows that government toll bridges in the United States earned an average of eight per cent on their investment, over and above all expenses.

Profits, as reported by government projects, however, do not always mean just the same thing as profits reported by private companies. In the first place, public ventures are tax exempt, a privilege which may cut their overhead by a substantial amount. Secondly, a government can usually borrow money at more favorable rates than private parties; Panama Canal bonds being sold to bear a very low rate of two per cent interest. Occasionally no interest is paid at all. The Inland Waterways Corporation was financed through congressional appropriation, as was the Alaskan Railroad; therefore neither system is disturbed about coupons or dividends on its stocks. In the case of prison industries, even labor costs may be abolished. Thirdly, a municipal electric plant may not be permitted to bring in large returns because citizens insist on having low rates for current. On the other

hand, competing business men cannot escape taxes, interest, or wages; nor are they usually satisfied with a very slight margin of profit. If sometimes more efficient in a technical sense than a governmental rival, they may still be unable to hold the market. So, in comparing public and private business, mere profits and sales prices are not an exact guide to their relative technical efficiency; other factors must be reckoned with as well.

**Government Enterprises Run at a Loss May Still Be Efficient.** Private business enterprises that fail to balance their books are destined for bankruptcy and transfer to new hands. In the case of government undertakings, however, deficits can be made up out of taxes for an indefinite period, and "bankruptcy" proceedings are rarely possible. Consequently, social motives may often be given precedence over profits without disaster. To illustrate: the Federal post office is a business enterprise, primarily engaged in handling letters and parcels for hire. But charges are not based solely on what the traffic will bear, nor are expenditures cut to a minimum. On the contrary literature for the blind is carried free of charge. Since the blind read by means of Braille type, which consists of raised symbols, each one of their books is very thick, and because there are few large collections for those who have lost their eye-sight, distribution by mail is highly desirable. Without Federal assistance in the form of free delivery, the bulkiness of such volumes would place a severe postage burden on readers. Encouragement of knowledge among the people is the announced purpose of a second service—that of transmitting newspapers and magazines from place to place at exceptionally low rates. Contractors for ocean and air mail haulage have been paid large sums to stimulate the building up of a marine and air fleet under the flag. No longer does the post office make money; but a deficit is not an absolute sign of inefficiency.

**Political Mismanagement.** Of course losses may also be due to obvious mismanagement. Many units of government

are, it is very evident, subject to corruption, which is likely to make trouble when they embark on business undertakings. Local bosses may reward their supporters with directing posts in engineering bureaus, regardless of their technical ability. Construction costs may be inordinately high, enriching builders as well as filling party chests or the pockets of interested politicians. Changes at the polls may result in sweeping shifts of men and policies, playing havoc with long-term planning. Managers may be so hampered with red-tape as to prevent them from exercising effectively their innate abilities for independent action. Furthermore, innovations may be delayed by the necessity for raising funds by bond referenda. Where such difficulties appear, public operation can be, and often is, a failure, from the standpoint of monetary return, requisite services, and engineering efficiency. Examples of this sort are constantly brought forward as arguments against government ownership.

**Conclusion.** It is impossible to draw from the so-called facts of public ownership any mathematical conclusion respecting the relative efficiency of public and private enterprise in the fields concerned. The facts cannot be listed under one classification or set of classifications with respect to their qualities; nor can all the variables be excluded from any picture or scheme of facts. When plants duly comparable in size and construction are brought into a study, some similarities and contrasts may be discovered to be fairly definite; a municipal plant may be getting more or less electric current from a given quantity of coal than a private plant of a comparable character. That is a problem in pure technology. But given fairly equal efficiency, the municipal plant may be yielding a small monetary return because the citizens demand a low rate. In many cases the government is in business because private interests have pushed it there, for one reason or another, or for reasons purely humane or social or political (such as national de-



fense), and not at all because tests of efficiency have been applied. Engineering science as such is not competent to say whether mail should be carried free for the blind or to pass judgment upon the ethics of public policy *versus* private enterprise; but engineering science can make an exact report on the mechanical efficiency of public and private plants that are comparable in nature—a test which, curiously enough, does not seem to have been extensively applied in any studies of this controversial subject.

### NOTE

#### FIGURES ON GOVERNMENT ENTERPRISES FROM A REPORT BY CARL D. THOMPSON

*Water-Works:* 1932—Public 7,853; private, 2,936 (number of systems); 1930 census: out of the 94 cities of over 100,000 population, 83 own their water works systems. (N. Y., Chicago, Philadelphia, Detroit, Los Angeles are five biggest cities with their own municipal systems. Largest private system is in Indianapolis, with pop. of 364,161); population served by municipal systems in these 94 cities is 43,768,039 and that by private systems is 1,766,048.

*Light and Power Plants (Municipal):* 1927—Public 2,198; private 2,137 (number of systems); current generated in millions of kilowatt-hours, in year 1927, is 3,379 for public and 71,307 for private plants; value of public plants is 417,167,000 dollars with 2,129,000 customers; largest cities with municipal plants: Birmingham, pop., 259,678; Los Angeles, 1,238,048; Jacksonville, 129,549; Kansas City (Kans.), 121,857; Cleveland, 900,429; Columbus, 290,564; Nashville, 153,866; Richmond, 189,929; Seattle, 365,583; Tacoma, 106,817; above includes all municipal plants in cities of over 100,000 population. Crisp County, Ga., has a county power project, said to be only county electric system in U. S.

*Municipal Natural and Manufactured Gas Plants in U. S.:* 1932—76 municipalities own their gas systems; largest of them are as follows (cities over 100,000): Long Beach (Calif.), pop., 142,032; Duluth, 101,463; Omaha, 214,006; Houston, 292,352; Richmond (Va.), 182,929; note, cities are as of 1932, but population is from 1930 census figures.

*Street Railways and Buses (as of 1932) Municipally Owned:* St. Louis, Missouri, pop. 821,960; waterworks railway—11 passenger or freight cars, track 7.5 mi., fare 5¢; 5 motor buses on 22 miles of route. Boston, Mass., pop. 781,188; city and state advanced funds to street car lines for extensions and on default on payments on same, the lines turned over a considerable

part of their securities to the city so that it has acquired part ownership in the system; the system so controlled is 441 miles long with 1,672 passenger cars, 304 service cars, 220 trailers and 3 electric locomotives. San Francisco, pop. 634,394; 234 passenger, 6 service cars on 84 miles of track; 18 motor buses on 11 miles of route. Seattle, Wash., pop. 365,583; 470 passenger, 55 freight, 31 service cars, 31 cable cars and 37 trailers on 234 miles of track; 60 buses on 65 miles of route. Tacoma, Wash., pop. 106,817; 9 passenger cars, 8 trailers, 2 electric locomotives on 27 miles of track; 2 motor buses on 16 miles of route. Duluth, Minn., pop. 101,463; waterworks railway, 2 miles track, fare 3¢. City of N. Y. owns subways, leasing some to private concerns and operating others. Other systems (1933):

Detroit, Mich.,	443	mi. track,	251	mi. bus route.
St. Petersburg, Fla.	35		23	
Phoenix, Ariz.	21		8	
Eureka, Calif.	12			
Ft. Collins, Colo.	7			
Pekin, Ill.	3			
Washington, Ind.	3			
Ashtabula, Ohio	7		40	
Monroe, La.	8		4	

*Municipal Ice Plants (1926) towns of over 5,000:* 15 municipal systems.

## CHAPTER XII

### FREE TECHNICAL SERVICES OF GOVERNMENTS

For various reasons American governments are engaged in rendering a large number of technical services without laying the full cost squarely on the beneficiaries. Concerning the wisdom or propriety of these activities, engineering science can reach no inescapable judgment, but in exploring its field it must take note of them. It is to such enterprises that the present chapter is devoted.

#### FREE SERVICES CONNECTED WITH TRANSPORTATION

**Improvement of Natural Waterways.** Among the oldest activities of governments is the improvement of waterways. Rivers and harbors, as found in nature, are often imperfect from the standpoint of quick and efficient transit. Sandbars, shoals, and rapids may be present in such profusion as to interfere with the passage of all but the shallowest craft. Improvements are therefore in order. In the absence of private zeal to act, as the years passed, governments were driven to shoulder the burdens of reconstruction themselves. By far the major share of developments is now Federal, since Congress possesses broad jurisdiction over all navigable waters and interstate commerce. National obligations in this connection are carried out by the Corps of Engineers of the United States Army, but state and local bodies have helped to a limited extent.

Under government auspices, rivers and harbors have been improved in all parts of the country. In the case of the Missouri, resort was had to regulation; that is, piles were driven at strategic intervals, to build up sandbars, while



revetments were installed at other places to prevent further caving of the banks. By properly locating such works, the stream is encouraged to follow a series of smooth curves at such speed as to maintain a channel of convenient depth at all times. Where regulation is not practicable, canalization may be tried. Thus on the Ohio, dams have been constructed to impound water in a series of pools. Shallow spots are then dug out; and boats pass from one lake to another through locks in the several barriers.

Vigorous prosecution of such projects has resulted in the creation of a noteworthy system of government river and harbor facilities. A nine-foot channel has been completed from the Great Lakes, via the Chicago Drainage Canal, to the Gulf of Mexico. As a feeder, a line also extends from Cairo, on the Mississippi, up the Ohio to Pittsburgh. Further to the east, a channel has been cleared from Birmingham, the South's prime coal and iron shipping center, to the sea below Mobile. Less ambitious are the six-foot tributary waterways that utilize the Ouichita, Cumberland, Green, and Kentucky Rivers. Altogether, in excess of \$470,000,000 had been taken out of the public treasury to pay for such works up to June 30, 1928. Nor is the process of development yet at an end. Future programs contemplate the establishment of a route to St. Paul, and another up the Tennessee to Knoxville. At the normal depth of six feet, it is proposed to open the Missouri as far as Sioux City. In addition to developing river channels, the Federal Government keeps in operating condition the entrances to approximately 125 salt water and 70 fresh water ports.

**Free Canals.** Besides improving natural waterways, governments build artificial routes. Generally no tolls are charged vessels making use of these works. Most prominent among the free canals are those comprising the Federal system. On the Great Lakes, important traffic in wheat and iron is detoured around the set of rapids between Lake Superior and Lake Michigan by the St. Mary's Falls Canal.

In 1929 over a billion dollars' worth of freight went through the locks in 700 hulls, ranking the unit among the busiest in the country. Turning our attention to the Atlantic Seaboard, we find a string of cuts serving as links in a well-protected inland route extending from Maine to Texas. First in order is the Cape Cod Canal, enabling ships to steam across a narrow neck of land, bound from Boston to New York. Further down the coast is the Chesapeake and Delaware Canal that passes boats between the two bays from which it takes its name. From Chesapeake Bay small craft may journey, sheltered from ocean storms, along a continuous line of inland canals dredged as far south as Florida. As a westward extension to the project, another canal, partly natural and partly artificial, joins New Orleans with Corpus Christi, Texas.

Most conspicuous of the various toll-free routes operated by other than Federal authorities is the Erie Canal in New York. Freight from the Middle West, upon arrival at the Great Lakes port of Buffalo, may be transferred to barges. The latter can then be towed through the Canal for 340 miles across flat plains, to the eastern terminus at Troy, on the Hudson River. Continuing down that stream, they may eventually reach the ocean at New York City. The main line has been enlarged from time to time until today it is twelve feet deep and seventy-five feet wide. As branch feeders for the same, one hundred and fourteen miles of additional channel have been dug. Despite the fact that up until 1926 the state had spent \$175,000,000 on improving the system, traffic since then has remained rather slight. It was to encourage more extensive use that fees were abolished, a number of years ago. Future expansions depend upon the fate of varied suggestions for constructing a waterway capable of admitting large sea-going craft directly to Great Lake harbors. A second major state enterprise is the ship canal joining Lake Michigan at Chicago with the Mississippi River through its tributary, the Illinois.

**Aids to Marine Navigation.** Not only do governments supply shipping interests with free rights-of-way, but Federal authorities render many other forms of assistance to the merchant marine. Dangerous shoals and reefs, or prominent points of land, are frequently marked with conspicuous structures. During the daytime, navigators can determine their true position by identifying this equipment through their glasses. Each has its distinctive shape or color: one lighthouse may be painted with red and white spirals, while another may be covered with black and white checkers. At night, many of these aids are lighted. Again, for the sake of clear identification, the lights commonly emit special combinations of long and short flashes. One may blink out two dashes and a dot, at intervals, while another sends three dots. Upon the advent of foggy weather, horns are sounded, or bells rung, in a special manner, every location having its own private signal. Moreover a number of shore stations possess radio-beacon or radio-compass apparatus whereby vessels, whether far or near, may obtain their bearings at all hours.

If unsatisfactory foundation conditions are encountered in shallow water, floating markers are employed. Buoys are anchored alongside cleared channels, derelicts, and rocks. For more important locations, specially designed lightships may be used. In any case, standardized colorations, numbering, and the like are resorted to as a means of guiding the stranger into port during the daytime. Buoys on one edge of a dredged entrance are ordinarily painted red, those on the other black, while lightships have their names painted on the hull in bold characters. At night many of these guides continue to be useful, owing to their distinctive lighting. Nor are they worthless in thick weather for during fogs they frequently send out automatic signals, by bell or whistle. Even radio directional apparatus is to be found on a few lightships.

Just as motorists ashore have their private guide-books, so

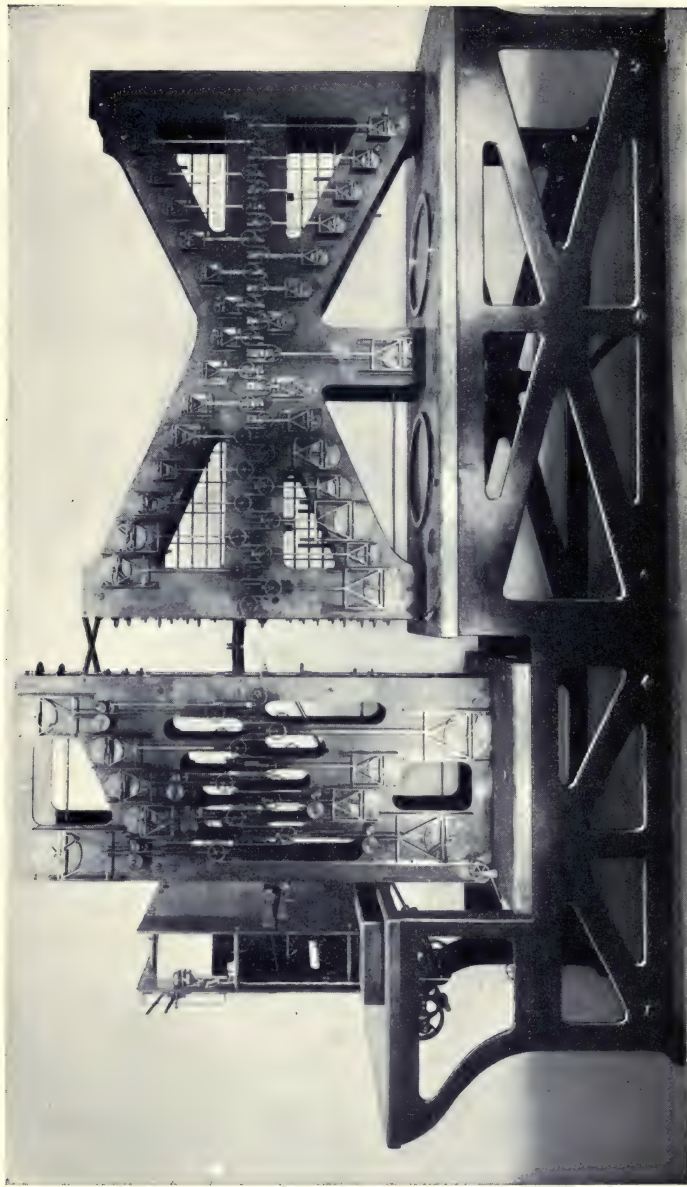




*Courtesy of the United States Bureau of Lighthouses*

#### A FEDERAL AID TO NAVIGATION

A government lightship, anchored at the entrance to Delaware Bay for the guidance of shipping.



*Courtesy of the United States Coast and Geodetic Survey*

#### THE SOURCE OF FREE GOVERNMENT TIDE PREDICTIONS

The "Brass Brain" of the United States Coast and Geodetic Survey, which predicts tides months in advance. Its results are freely distributed to private shipping interests.

navigators by water are supplied with maps and information. Federal authorities issue a series of coastal charts, indicating beaches and cliffs, prominent landmarks, the depth of water at many scattered points, and the position of buoys and lightships. To accompany these charts, they print the "Coast Pilots" containing data on such items as landmarks and fuel supplies at major harbors. Not only are publications available for American waters, but they cover many other sections of the world. Strangers in the seven seas, accordingly, may feel much at home with such copious official sources at their finger-tips. As a supplementary service, tables are distributed from time to time giving estimated heights of the tides for leading ports several months ahead.

**Locating Icebergs.** Following the *Titanic* disaster of 1912, still another service was instituted, that of locating icebergs. Annually Federal vessels are assigned to the task of cruising around in the North Atlantic on the lookout for ice. Any large pieces thus discovered are reported by radio to all steamers plying in the American-European trade. As the shortest route between the two continents lies far North, this work has an important bearing on fuel consumption in the merchant marine, as well as on the safety of passengers and crews.

**Highway Work.** Turning from water to land transportation, the importance of roads first attracts our attention. Roads enable farm children to get to school. They permit rural dwellers to reach town and *vice versa*. They are a vital element in adequate mail and freight transport services. They help to "civilize" remote regions. In short, highways are essentials of modern life. At one time private companies were often authorized to provide the necessary facilities on a toll basis, but the practice fell into disfavor as highway transportation increased, especially after the advent of the automobile. With its advent a demand for free thoroughfares arose, which obviously only the non-profit-making governments could meet. Consequently the building of



roads has become almost entirely a governmental function. All types of political bodies are involved in the work. Federal authorities are responsible for routes traversing national parks, forests, and Indian reservations. States have assumed the responsibility of constructing and maintaining thousands of miles of major arteries, sometimes with Federal aid (p. 302); while cities, towns, and counties are busy with local construction and maintenance.

There seems to be a general tendency, however, toward taking highway work out of the hands of small, poorly equipped bodies and placing it in the hands of larger central authorities. The shift begins with supervision over the expenditure of grants in aid made by the Federal Government to states, and by states to localities. In thirty-five cases, states have taken the next step, assuming full control over major arteries, and doing it so well that the term "state road" is synonymous in the minds of the ordinary traveler with the best of surfaces. North Carolina, going even further, now has charge of all rural road activities, leaving nothing to local management except city streets.

On the construction side, the last three decades have witnessed remarkable progress. With the growth in motor vehicle travel, better varieties of paving have been laid down. That the change is often warranted is revealed by the fact that as much as thirty per cent of the running cost of an automobile can be saved by transferring it from a low-grade to a high-grade surface. Improvements in location parallel those in surface. For one thing, the early plan of building roads radially from towns into the surrounding country forced through-traffic to mix with local traffic. In order to afford relief, detours around metropolitan centers or super-highways across them are now the vogue. The latter are placed at a different level from ordinary streets, for the purpose of eliminating crossings. In other words, long-distance operators may pass around or in and out of crowded industrial centers with a minimum of inconvenience, and

at the same time the congestion in the city streets is relieved, helping local residents.

On the maintenance side, governments also shoulder important burdens. It is estimated that in 1928 there was a total of over 3,000,000 miles of public roads in the United States. Repair work on such an extensive system naturally assumes large proportions. But this is not all, for routes must be opened during cold weather and in the northern tier of states fleets of modern plows are set in motion, at the first signs of snow, to clear off the highways so that bus and truck owners may keep their schedules, and distress among snowbound citizens may be relieved.

**Airways.** With the development of aviation, governments turned their attention to still a third medium of transportation. True, it was perfectly possible for aircraft to pass over any type of terrain, depending solely on facilities offered by regular airports. But the hazards involved made it out of the question to conduct extensive commercial business on any such basis. The need for further equipment, in the interests of safety, being generally felt, the question naturally arose as to the party that should furnish it. Private companies could not well assume the burden of cost required to build pioneer airways; political agencies, being backed with ample funds, could. Since the latter had already improved many waterways, installed hundreds of lighthouses and buoys, and constructed thousands of miles of free roads, convincing precedents existed for promoting additional means of travel. Furthermore, national authorities were eager to try the experiment of carrying mails by air. These various factors resulted in throwing upon Federal and state bodies the task of providing aids to aërial navigation.

A typical airway, as maintained by the Federal Government, is laid out so as to afford the best path. Directness is sacrificed only when compensatory benefits are to be derived from detours that take machines over better landing grounds or otherwise promote their safety. The "ideal" route

is marked for daylight flying by means of conspicuously painted towers and colored arrows. However, as long as the sun is up, prominent geographical features constitute an easier guide. At night, the towers become brilliant beacons, spaced at convenient intervals, so as to give the pilot a long chain of lights to follow. Supplementary bulbs indicate the position of each, relative to the starting point. As an additional aid in preventing planes from losing their way, radio-beacons are kept in action. Aircraft have only to pick up distinctive signals from these instruments to tell whether or not they are staying on their proper course. In this way continuous correction of direction becomes possible even when running "blind" through fog or dense clouds, out of sight of earth or sky.

It is not enough to make certain that planes are on their course. Account must also be taken of storms, fog, and mechanical failure while in flight. To this end a continuous weather service is maintained along the national airways. Through radio broadcasts, information collected from many observing stations is transmitted to planes, warning them of dangers before they are reached. If immediate descent, due either to bad conditions ahead or engine breakdowns, becomes imperative, reliance may be had on emergency fields, located at strategic intervals in the line, where forced descents would otherwise be extremely hazardous. In the daytime such facilities are easily distinguishable, while at night most of them are kept lighted for use at any hour.

Taken as a whole, the various units of American government operate an important system of air routes. By far the major responsibility is carried by Federal authorities. In 1930 the latter maintained 13,500 miles of lighted airways, supplied with 1,500 beacons and 319 emergency fields. To this total may be added a long mileage of lines equipped solely for day flying. In addition, 200 special aeronautical weather stations cover the country. On the entire enterprise



the nation spends about \$7,000,000 a year. Following the national lead, a few states have sought to establish supplementary feeders; and Idaho, Virginia, New York, and Pennsylvania have already paid out considerable sums for the necessary preliminary work.

### FLOOD CONTROL

**Flood Damage.** So much for transportation. Now we turn to a consideration of the havoc wrought by excessive rainfall. The need for official aid in combating inundations is nowhere better illustrated than by the history of the Mississippi River during two disastrous seasons. In 1912, 250,000 persons were rendered homeless by its floods; to railroads alone the property damage from swirling waters reached over \$6,000,000. A single line, the St. Louis, Iron Mountain, and Southern, had 352 miles of track submerged, some of it for over five months, and 369 miles more put out of commission. Repairs cost \$875,000 while loss of traffic during the tie-up was figured as worth \$746,000. Fifteen years later, in 1927, a still mightier torrent flowed down the valley. This time portions of seven states were covered; 700,000 people were driven from their homes, as sixty cubic miles of water sought a path to the Gulf of Mexico; 250 people were killed; and millions upon millions of dollars worth of crops, houses, machinery, and miscellaneous items were destroyed.

Tragic scenes, if on a much smaller scale, are to be found described in local records elsewhere in the land. A case in point was the 1913 flood on the Miami River, Ohio; 361 individuals are definitely known to have been killed in that disaster and probably many more were dead—persons reported missing but never found. An estimate of the total property damage placed the figure at \$67,000,000. At Hamilton, 200 houses were washed from their foundations, disappearing to points south. Nor were those that remained in place in much better shape, for water freely entered many

of them, destroying wall paper and plastering, warping doors, dissolving the glue that held furniture together, ruining pianos, and depositing heavy layers of sticky clay over the lower floors. In certain places, such high velocities were attained that sheet asphalt streets were torn up, and the earth beneath the surface was scoured out to a depth of several feet. Railroad embankments melted away. Bridges were wrested from their piers. In some instances the topsoil of farms was entirely removed, while in others thick gravel was dumped upon tillable ground with equally disastrous results. Naturally such wholesale havoc arouses strong popular feelings, creating a demand for the installation of proper control facilities by governments, Federal, state, and local.

**Early Mississippi Control Plans Fail.** As our greatest river system, the Mississippi calls for the most elaborate flood-control program in the country. The first efforts to tame the mighty stream were made by private enterprise. Planters along the banks built continuous earthen dams, known as levees, as barricades against high water levels. But nature and the Civil War conspired to end this era of individualism. A new period was ushered in with the passage of state laws permitting regions to form special governmental districts having the power to tax all affected lands as the means of defraying the expenses connected with the erection of suitable levee lines. Before long the permissive right brought action and after years of building, a line of levees marked an apparent triumph over nature. Yet this monument to human will crumbled to pieces in 1927, as raging torrents overtopped or broke through weak points in the system and caused almost as much damage as if nothing had stood in their way. Since the blighted areas were too poor to carry on the struggle alone and since all previous lessons pointed to the necessity for a new approach to the problem of flood control, an appeal was made to the Federal Government. In reply, Congress offered to step in, suggest-

ing the execution of a comprehensive plan, with \$325,000,000 in national funds to back it up.

**Federal Flood-Control Plan on the Mississippi.** This new Federal plan contemplates the completion of a system of standard levees from Cairo to the Gulf. Present earthen walls are to be raised and widened where necessary, while existing gaps are to be closed. To prevent the river from undercutting the banks on which barriers have been so painstakingly erected, revetments are to be installed on sharp curves. Yet it is not expected that the works will keep the stream in check during major floods. On the contrary they will merely serve to hold back average rises in water levels. If dykes could be built high enough to handle any possible flow without danger of a break, the cost would be prohibitive. But the low structures will not be entirely useless even in extreme emergencies for they will serve as a first line of defense, giving the inhabitants of the valley time to prepare for trouble.

To care for onrushing torrents, which threaten to surmount this first line of defense, provision will be made for a system of floodways. These works are essentially broad raceways, guarded on both banks by strong levees, through which surplus water may be detoured with safety around major constrictions in the river bed. By effecting a marked widening in available channel space at spots that are dangerously narrow, they will keep levels at a safe figure at troublesome points from Cairo to the Gulf. During flood-time, reliance is placed on an automatic device, known as a "fuse plug" section, for opening up the several bypasses at the proper moment. The head of each artificial basin is blocked against the river with an earthen dyke slightly lower than a standard levee. Being first overtopped by floods, the dykes will be washed out and in this manner the remaining levees can be saved while the overflow pours into the emergency basins and side routes. During normal years, the floodway basins and routes can be planted with crops, bringing a very fertile



agricultural country under cultivation. Nevertheless the occupants are fully aware that their property may have to be sacrificed to the common good on the rare occasions when nature goes on a rampage. Altogether three of these units are contemplated—one below New Madrid, another in the Bœuf Basin, and a third in the Atchafalaya region. For the protection of New Orleans, near the mouth of the Mississippi, special steps have been taken. A permanent concrete spillway is located above the city. At high stages the peak flow is partially short-circuited over the dam into a wide valley which empties into Lake Pontchartrain. From that Lake it readily drains off into the sea, a short distance away.

Owing to the magnitude of the project, it has been subjected to inevitable criticism from technical experts. Some of them place reliance on larger levees only; others suggest a series of giant impounding reservoirs. But despite the various claims and counter-claims, the official Federal plan is being steadily pushed forward. The New Orleans spillway and relief channel is already completed. Considerable progress is also reported on the system of standard dykes as well as on the three floodways. Still, at this writing, the enterprise is far from prepared to meet severe emergencies; and it will not be possible for some years to tell just how effective the program will be under actual service conditions.

**Localized Flood-Control Works.** While the Mississippi project justly attracts unusual attention, it is but one of a series of flood-control enterprises that protect communities in various sections. Typical of a multitude of minor works are the undertakings of the Hudson River Regulating District in New York State. This unit of local government was created for the express purpose of preventing repetitions of the damage wrought by a 1913 inundation, which accounted for a property loss of over \$1,000,000. The District places reliance, not on levees, but on a string of large reservoirs for impounding excess rainfalls until such time as they may be safely released. Eventually sixteen such basins

will be provided, the largest to cover forty-two square miles. Altogether the entire system will have a capacity of 80,000,000,000 cubic feet and will represent a capital outlay of approximately \$30,000,000. Not only will washouts and submersions be guarded against, but during dry stages in local streams sufficient water will be turned in to maintain a satisfactory flow. Hydro-electric plants may thus be kept running steadily and sewage may be properly diluted at all times, forestalling the appearance of unsanitary conditions at critical seasons.

### WASTE REMOVAL

**Need for Waste Removal Works.** Sometimes in connection with flood control and sometimes independently, governments are compelled to provide for the disposal of sewage and other wastes. As the country has grown up, a steadily increasing population has brought a more than corresponding rise in the quantities of household wastage to be carried away in a sanitary manner. Owing to the extraordinary extension of the factory system, great volumes of chemical wastes are poured into rivers and harbors; these include laundry rinsings, dyes, and liquors from gas plants. Furthermore the erection of buildings close together and the installation of hard street paving prevent the ground from absorbing rains and make necessary special facilities for storm-water removal in order to prevent the flooding of cellars and to render streets passable in all kinds of weather. Waste disposal therefore constitutes one of the prime duties of government and a gigantic "industry" in itself.

**Reasons for Government Operation.** In only a few cases are sewage systems run by private concerns as public utilities on a fee basis. As a general rule, all wastes are handled by cities, special districts, or other units of local government. Several factors explain this trend. For one thing, it is rather difficult to arrange a fair scale of charges to cover the removal of liquid refuse, since metering is im-

practical. Consequently it is simpler to turn the function over to political agencies which can meet costs from taxes. Besides, grave issues of public health arise. If disposal plants were run for private profit, managers, in the interest of private gain, might overlook conditions imperiling the welfare of the community. Another consideration may be cited: city authorities are responsible for the maintenance of streets and this gives them a direct interest in the run-off question. They are forced to deal with water coming from heavy rains as well as from street flushing.

**Local Sewage Plants.** Taken as a whole, the extent of governmental sewage works in the United States is impressive. One estimate places the total mileage of mains in the country at 100,000 and their original cost at \$1,000,000,000. To them must be added many miles of feeders in individual cities. Detroit had over 2,000 miles of line in 1927 and her equipment was worth \$100,000,000. One major conduit contained three parallel sections, each 16' by 18', indicating the tremendous volumes to be handled.

Wastes gathered by city trunk lines may be disposed of in either of two ways. The simplest process is to empty them into a watercourse of sufficient size to render them innocuous, if such a stream is available. However, as the volume of sewage increases, a point is reached at which rivers and harbors are unable to carry the load properly. Offensive and dangerous conditions readily develop. Thus "Bubbly Creek" near Chicago was so filled with effervescing solid particles that a heavy scum formed on the surface, the escaping gas accounting for the local name. At times the resulting top layer was so thick that a person could walk upon it as if on soft ground. Besides being objectionable to the nose and the eye, gross pollution presents hazards to health, especially since the fluid discharged from one city frequently enters into the drinking supply of another. Among the diseases that may be transmitted from place to place by this means are typhoid fever, dysentery, and Asiatic



cholera. Moreover industrial wastes, unless treated, may give rise to all kinds of chemical nuisances, perhaps poisoning fish or polluting water used in other industries. So it is often imperative that governments construct plants to purify sewage after collection and before it is thrown into nearby channels.

Owing to the tremendous volumes to be handled, many municipal purification systems reach mammoth proportions, notably the engineering enterprises of the City of Chicago. As the direct outcome of a court edict forbidding the local sanitary district to divert lake waters (p. 36) in sufficient quantities to provide adequate dilution, the area had to undertake a comprehensive construction program. Briefly described, the project divides the region into five zones, each with its own plant. To supplement the regular zone enterprises, two additional works are to be built to take care of special industrial wastes. One of the latter is designed to screen the output from stockyards and meat-packing establishments; the other is to absorb the flow from a large corn-products factory at Argo. When completed, the whole equipment will cost almost \$100,000,000. A single installation, the North Side station, covers ninety-seven acres and receives 175,000,000 gallons a day—the domestic drainage from seventy-eight square miles. Nor does this Middle-West development represent the ultimate in size, for the task of controlling fluid refuse from our largest metropolitan unit, Greater New York, dwarfs all previous problems elsewhere.

**State Supervision of City Sewage Plants.** With the growth of industries, many major watercourses are becoming polluted in fact, and through the fault, in part, of a few communities which, by shirking their responsibilities, tend to nullify the purification efforts put forth by the remaining units in the same shed. Accordingly it is imperative that some means be found to force all cities bordering on a given stream to coöperate in clearing it. So some states, through

their boards of health, have developed comprehensive sanitary plans for their entire jurisdictions. The Sanitary Water Board of the Pennsylvania Department of Health, for example, has classified the waters of the state into three categories: (a) the relatively clean; (b) those in which wastes are noticeable but not beyond control at reasonable cost; (c) those so filthy and so unfit for public drinking supplies that restoration of suitable conditions is neither practicable nor economically feasible. Often a central body possesses the right to force local governments to conform to its general program of development. Thus in Pennsylvania the Sanitary Board determines the minimum grade of effluent that may be emptied into given channels and controls the processing of sewage through the issuance of permits prior to the installation of treatment equipment. Much the same practice prevails in Indiana, where the Board of Health has ordered Newcastle and Washington to build sewage plants of a specific type. The move towards broad engineering planning is making headway in sewage disposal as in so many other fields (Chapter XVII).

**Garbage, Ashes, and Rubbish.** Besides sewage there are solid wastes—garbage, ashes, and rubbish. The latter are generally collected at periodic intervals by city forces and hauled to disposal grounds. Sometimes recourse is merely had to dumping on the outskirts of the city or at sea. A more modern method is to burn refuse in incineration furnaces, thereby avoiding unsightly and obnoxious dumps. As an alternative, in the case of garbage, reduction may be employed. Reduction involves the cooking of wastes in great vats and the extraction of valuable constituents, such as fats. Millions of dollars have been invested in incineration and reduction plants by cities, towns, and villages.

#### EMERGENCY SERVICES

**Extent of Fire Damage.** Apart from their public works, various units of American government operate free emer-

gency services to save lives and property in times of peril. One of the oldest of these activities relates to the fighting of fires. And a challenging task it is too! The amount of property destroyed by fire in the United States during 1929 was \$475,000,000 or almost \$4 per capita. Major cities experience several thousand blazes every year, New York having been afflicted with 26,000 in 1928. In addition to the direct losses, the value of which can be determined, there are sacrifices of time, wages, and other intangibles, the precise total of which cannot be figured in dollars and cents. What is more distressing—many persons are killed or injured in burning buildings. An extreme case was the loss of life in the Iroquois Theater disaster in Chicago in 1903, during which five hundred seventy-five persons met a tragic death. It is estimated that 10,000 people are killed annually and that 25,000 are injured in fires. Seeking to put a check on such wholesale destruction, municipalities maintain fire-fighting systems.

**Fire-Alarm Systems.** Although special arrangements are made with telephone companies for communicating fire alarms to the nearest engine house, there is need in the larger cities for additional signaling systems. People detecting smoke may not know just where to find a telephone or may not have the correct coin for using it even if one is available. Then there may be some delay in getting the central office to complete the connection with the fire department. For convenience and prompt action, therefore, leading communities have installed fire-alarm telegraph nets, publicly owned and maintained. To use the equipment one has only to step to the nearest box, turn a knob or pull a hook, and wait for the enclosed machinery to do the rest. Each location sends out its own private code number which, on reaching headquarters, is relayed to the appropriate station. There it actuates gongs or indicators, giving firemen the exact position at which an appeal for help has originated. Engines immediately start for the spot.



Speed being the prime object of a municipal fire-alarm telegraph system, boxes are usually located conspicuously and are painted red. They are also spaced at short intervals so that the passerby does not have to run far to transmit his call for help. In New York City, for example, the longest distance one must ordinarily travel to reach a box is four hundred feet. After the right knob has been turned, or hook pulled, warning signals should arrive at the proper station within a minute or two. New York City records show that on the average only fifty seconds elapse between the operation of a signal and the final stroke of the indicator in the nearest fire house. Usually the apparatus is rolling out of the door as the last note sounds.

**Location of Fire Stations.** Of course the speed with which motors reach the scene of trouble depends upon the skill shown in locating stations. Running-periods to any portion of the area covered from a given headquarters must be reasonably short. Where traffic conditions are unfavorable, fire houses must be placed close together. The distance between them also depends upon the quantity of apparatus that must be concentrated in the district. Obviously a crowded wooden tenement section requires the presence of much more equipment than does a region containing detached bungalows.

**Fire-Fighting Equipment.** For fire-fighting purposes modern technology has provided an imposing array of apparatus. If there is a scarcity of water, or oils have been ignited, chemical engines may spray a non-combustible, bubble-filled mixture upon the blaze. In the skyscraper districts of large cities, special mains supplement the ordinary sources and under high pressure force water to great elevations without the aid of any fire engines. Heavy trucks are equipped with water towers which can be raised in the air and made to force streams directly at flames, thus obviating the hazards connected with the carrying of lines up walls and over roofs in danger of collapse at any

moment. For waterfronts, fire boats afford additional protection to ships, docks, bridges, and warehouses. Some of them are powerful craft: the *John J. Harvey*, of the New York City force cost nearly \$600,000 and can discharge 16,000 gallons a minute through thirty-two nozzles. Hooks, ladders, and nets are employed in rescuing persons in peril of their lives. Torches are used to cut through steel bars and other impediments blocking access to flames and smoke. In the night powerful searchlights are operated, illuminating dark and dangerous places.

**Skill of Firemen.** The chief in charge at a fire, therefore, has at his command a large number of instruments, each capable of performing a specific task with a maximum of efficiency. It is his duty to dispose these units about the blaze in a strategic manner. Advantage must be taken of every development in the battle. An eye must be kept open for the possibility of collapses in walls, floors, and roofs so that men can be withdrawn in time to save their lives. Adjoining structures must be soaked to prevent the spread of flames. Dust explosions must be avoided. If nothing else suffices, buildings may be dynamited on a grand scale, to clear a barrier against the menace. So rapid is the succession of events at a large fire that a high order of technical skill and a quick wit are required of the officers; the history of many of our fires revealing true generalship. If the flames seem to be gaining headway and reserves are wanted, they may be assembled from more and more distant stations. A fourth alarm brings, as a rule, the ultimate in concentration of local equipment, even for large-sized towns. For serious cases, outside help may be needed and in this motor era it may come from a radius of fifty miles or more. During the dreadful Baltimore fire of 1904, men and engines were imported from as far as New York City.

**Fire Salvage.** Formerly the objective of fire fighters was to extinguish flames regardless of damages incidental to the deed but this narrow view of responsibility is now

yielding to the rule that all losses should be confined to the minimum. Indeed many cities now provide a special salvage service whose duty it is to rush to fires and remove endangered property. If the salvagers find that the flames have got too much of a start, they try to limit the ravages of smoke and water by throwing tarpaulins over property that cannot be removed to a place of safety. Extending their activities in other directions, salvage squads may temporarily patch holes cut or burnt in roofs, doors, or windows, through which rain or wind storms might play further havoc after the firemen have departed. Such salvage work, although little known to the general public, increases the benefits derived from the services of municipal fire forces.

**Rescue Squads.** Many modern fire departments possess one or more rescue squads, supplied with gas masks, fireproof suits, pulmotors, first-aid apparatus, and similar special equipment. These squads, braving dangers of every kind, remove and revive persons trapped in burning buildings. They are also accessible, upon call, for other tasks. A baby has stopped breathing; the squad tries to resuscitate it with its pulmotor. A leak develops in a refrigerating system; gas masks are taken to the scene, where repairs are made. As masters of many trades, members of these squads stand ready to perform a wide range of duties in line with modern ideas of civic responsibility.

**Marine Rescue Activities.** To the perils of fire and other emergencies on land must be added the calls of the sea. Here we again find the government always ready to lend a helping hand. An emergency service for vessels is operated by the Coast Guard, a branch of the Federal Treasury Department. To provide succor for ships that have run aground or are in distress, life-saving stations have been erected at intervals along our coasts. Using these as centers, patrolmen cover scheduled "beats" up and down the shore, keeping a sharp eye out for steamers in distress. When such a craft is located, the watchman signals his home office for assistance.



He also notifies the ship in trouble, by means of rockets or other devices, that it has been found. Upon receiving notification that help is needed, the nearest headquarters force of men and machinery hurries to the scene of peril and goes into action at once. Lifeboats may be rowed through the surf to save lives and property. If the breakers are too strong, a life-line may be shot to the rolling hulk so that a carriage, running on a trolley, may be used to transport the shipwrecked passengers and crew to firm earth and safety. The rescue over, the drenched group is given shelter and comfort until provision is made for travel to nearby communities. The desolate character of shore lines for hundreds of miles lifts this heroic work to a function of high value.

While stranded vessels receive the most attention, coast-guard cutters also patrol waters to some distance offshore during stormy weather. Small craft caught in the clutches of heavy seas are thus discovered and aided in systematic fashion. During the winter of 1929-1930 at least twenty-five ships were accorded relief by Federal crews. Besides routine cruising of this sort, special searches are made of wide areas upon request, when ships are thought to be in peril, even though they are small. For instance, if reports reach headquarters to the effect that a given boat has not been heard from when due, a surface fleet or an airplane squadron or both may be pressed into the service of searching. Where humanly possible, missing parties are located and aided if in need. Records for the year ended June 30, 1930, indicate that the Coast Guard justified public support. During that period it rescued several thousand persons from peril and gave aid to millions of dollars' worth of shipping.

**Mine Rescue Units.** In the depths of the earth as well as upon the streets of cities and the waves of the sea, government renders emergency services. When miners are entrapped underground, through explosions, fire, or cave-ins, they must be succored without delay or they may be suffocated. In recognition of the danger, Congress fostered

the national Bureau of Mines and provided it with an extensive equipment of rescue apparatus. For dispatch over railroad lines to scenes of trouble, it owns several all-steel coaches, each outfitted with a full complement of necessary devices. For use on the regular highways, a number of motor trucks, similarly equipped, are ready to start on a moment's notice, carrying aid to the injured. In case of disaster, the nearest rail car or motor truck responds and is placed at the service of local authorities immediately upon its arrival at the place of distress. Federal agents accompany the rigs, prepared to give whatever assistance they can. Such work still appears to be indispensable but as private safety work gains momentum, this duty may decline in significance.

**City Ambulance and Hospital Service.** Since a considerable proportion of our urban population lives close to the margin of subsistence, thousands of people are unable to pay for medical attention. If they are suddenly seized with illness or are badly injured, the burden of caring for them falls upon the community. Recognizing the inability of private philanthropy to meet the entire demand, many municipalities have organized emergency health services. For minor cases, free clinics are established where the poor have access to a variety of specialized treatments. Patients in graver condition are taken to city hospitals. Sometimes they supply their own transportation. Upon other occasions, where haste is a consideration, they may be transported in city ambulances. Frequently the police department assumes the responsibility for transportation in cases of automobile accidents, explosions, cave-ins, fires, and other disasters in the cities. Within the public hospitals the sick and injured often enjoy a high grade of modern scientific service.

**Special Relief Operations.** Continuous protection against all emergencies is not feasible and when a disaster suddenly strikes a large center of population, relief must often be

especially organized on the spur of the moment. Just such a need was felt in the Mississippi Valley during 1927. Allusion has already been made to the extent of the damage done—700,000 persons made homeless and millions of dollars' worth of property destroyed. In answer to feverish calls for help, measures were taken at once to ameliorate suffering, a large share of the task falling on a private body, the American Red Cross. But Federal, state, and local authorities were also quick in lending their assistance. In fact, the United States sent a portion of its "rum-chasing" fleet to the stricken area, together with vessels from the Navy. Three trainloads of coast-guard life-saving crews and equipment were hurriedly dispatched from the New Jersey shore to the inundated region. About sixty Army and Navy aircraft flew to the scene of desolation. Planes performed scouting duty over the flooded terrain, locating the mounds on which persons were huddled, hoping to be rescued. This information was conveyed to the surface craft which immediately proceeded to the designated spots and removed the helpless victims to a place of safety. On account of their long experience in battling with dangerous surfs, the coast-guard crews undertook the more hazardous part of the work, fighting swirling currents with their accustomed bravery.

After they were picked up by government boats, homeless people were disembarked at the Red Cross camps. To supply the latter with sufficient facilities for housing needy multitudes, United States Army and state militia storerooms were stripped of cots and tents. Special assistance was rendered in the only case where an inundation was deliberately planned. To protect New Orleans from rising river levels, preparations were made for blowing up a levee south of the city and upon Army trucks fell a considerable share of the burden of evacuating farmers and their property. Following the arrival of the farmers in New Orleans the group of refugees was given living quarters in the regular



military base. In combination, governments spent about \$7,000,000 in aid of the Mississippi flood victims.

Numerous other instances of government help in time of need might be cited, for example the San Francisco earthquake of 1906 and the Vermont flood of 1927, but on account of space one more episode must suffice—that caused by a drought in the Northwest late in 1929. The municipally owned power and light systems of Seattle and Tacoma, Washington, experienced a grave shortage of water at their hydraulic plants and due to a lack of sufficient steam stand-by capacity an acute situation developed. Faced by this plight Tacoma petitioned Federal authorities for assistance. In reply, the giant naval aircraft-carrier, *Lexington*, was ordered to the spot. Upon its arrival, heavy cables were brought ashore, the huge generators in the ship were started, and energy immediately flowed into the awaiting electric net. In such unique ways government may come to the aid of communities in distress.

### INFORMATIONAL SERVICES

**Need for Information.** American governments, as builders and managers of elaborate technological enterprises, must have at their disposal a wealth of statistical information on current conditions, if they are to discharge their duties properly. They must possess maps of their respective jurisdictions for mineral leasing, road-building, planning, or tax-assessment purposes. They must know accurately the total population figures and extent of industrial activity within their respective boundaries as a basis for the design of water-works or sewage systems. During times of depression, when the task of caring for millions of unemployed falls upon them, they should be conversant with trends in manufacturing output, the size of payrolls, and occupational opportunities. Without relevant data, the work of government cannot be carried out effectively. But the interest of governments does not end with a mere satisfaction

of their needs, for as public servants they also seek to assist citizens in quest of enlightenment respecting a multitude of matters not directly related to emergencies and public services. The knowledge so assiduously accumulated is, therefore, widely disseminated among private parties and where a popular demand exists for supplementary facts, statistics may be gathered that pass beyond the requirements of the official routine.

**Surveying and Mapping.** One of the most important of the informational services rendered by political bodies is that which provides atlas data. A wide range of maps is published by Federal and state authorities, and sold to cover the mere cost of printing—the burden of intricate surveys being borne entirely by the governments involved. As a foundation for its cartographic operations, the United States Government has established a triangulation network, consisting of a series of lines and angles, mathematically adjusted until the relative location of innumerable marked objects is properly fixed. Leveling parties complete the work by adding figures on altitudes. Anyone wishing to obtain full details as to the position and elevation of these basic “bench-marks” has only to write to the Coast and Geodetic Survey at Washington, D. C., for particulars. Frequently state highway departments, hydro-electric power companies, and other concerns save substantial portions of their reconnaissance expenses by utilizing national monuments.

With triangulation nets as a base, the Federal Geological Survey prepares topographic maps, each depicting a limited quadrangle. On them are indicated relief, by means of contour lines; waters, such as rivers, lakes, and marshes; and the works of man, including roads, towns, and railways. Through the judicious selection of scales, considerably more detail is given for densely settled areas than for sparsely populated desert tracts. Already charts are available for approximately half the surface of the country. Ultimately

it is intended that the remainder will be fully covered in an identical fashion.

Accurately to depict geologic conditions existing in each quadrangle, Federal engineers have begun the preparation of a complete series of supplementary folios. In a typical folio are included charts showing relief and culture; historic formations; existing mineral deposits and mine shafts; and the depth and shape of the various rock strata, in cross-sectional form. Accompanying the graphic presentation is a written description, giving further details. Owing to the great effort involved in putting out these publications, they cover as yet only a very limited portion of the country.

For the benefit of special interests, distinctive cartographic work is undertaken by the Federal Government. Mention has already been made of the coast charts prepared for the guidance of mariners (p. 391). A similar map service is also provided for airplane pilots; strips are issued showing major landmarks, such as lakes, rivers, mountains, towns, highways, and railroads; flying facilities are indicated, including beacon lights, emergency landing fields, and regular commercial airports. The farmer also receives attention in surveys made by the Department of Agriculture of soil conditions throughout the country. Test holes are drilled at representative points, to ascertain the nature of loam, gravel, and other surface formations. The findings of this reconnaissance are then depicted in graphic form. As in the case of geologic folios, each study is accompanied by supplementary written descriptions of prominent features.

**Weather Data.** No geographical survey of the United States would be complete that failed to add material on climate to that available with respect to topography and geology. Periodically, therefore, observers of the national Weather Bureau take readings of wind speeds, rain- and snow-fall, temperature, and barometric pressure. Simultaneously, fellow workers in the Geological Survey are busy making measurements of the quantity of water passing down the



leading rivers. From hundreds of scattered stations, data pour into central headquarters, there to be classified, analyzed, and preserved. Past files are freely consulted by engineers for many purposes. Some look up stream gaugings with an eye to estimating flows as a basis for designing flood-control systems, city reservoirs, hydro-electric projects, or bridges. Others are interested in maximum wind velocities or snow loads on buildings. But Federal statistics are of more than historic interest, for current conditions offer clues to the future. Where findings as to atmospheric disturbances indicate approaching danger, warnings are sent out to boats and airplanes, to prevent them from running into the teeth of perilous storms.

**Population Figures.** While examining in detail the physical environment in which they operate, governments must also study man and his works. A major project, of the latter sort, consists of the decennial census. Every ten years, as required by the Constitution, an army of Federal enumerators goes to record the population of the nation by political units. More than just head counting is involved, for the age, sex, occupation, race, and nationality of individuals are ascertained. A huge task it is, for approximately 100,000 workers are employed, as well as a battery of the very latest computing and tabulating machines. Published results are sold at the mere cost of printing. Data thus collected are used by engineers to plot curves which, by projection, may be used to predict the future growth of cities. These extended lines act as guides in designing water-works, telephone, electric, and other plants capable of providing adequate service over a specified period of years from the completion of construction.

**Statistics on the Works of Man.** Works of man also receive close attention. Periodically Federal agents survey the extent of our capital equipment, such as electric central station capacity, acreage of agricultural land under cultivation, or miles of railway and telegraph lines in operation.

The annual output of farms, mines, and mills is recorded, including coal, oil, copper, and iron extraction, and the number of motor vehicles, locomotives, or bushels of wheat manufactured or grown. By such means our ability to turn out goods may be checked against our actual production, to determine the efficiency with which we are using existing facilities. A valuable little volume, *The Statistical Abstract of the United States*, published by the Department of Commerce, contains a veritable mine of important figures on these topics.

Studies of the physical environment in which we operate, of the capital equipment now available for production purposes, of annual output, and of the population which it must serve, afford a fairly complete picture of the condition of the country. Weaknesses and lost motions stand out conspicuously. Here, then, we have salient information which serves as a basis for the present concerted attempt to plan and control national economy on a large scale (below, Chapter XVIII).

**Scientific and Engineering Research.** Original scientific and engineering research constitutes another phase of government activity. Much of this research is indispensable to the efficient operation of governments, for public authorities, as users of a wide range of supplies, are under obligation to improve their technique and to find ways and means of lightening the taxpayers' burden. To be specific, an important item of treasury expense is the printing of money with which to redeem crumpled and torn bills. Attacking this problem the United States Bureau of Standards installed a small mill with the object in view of discovering a more durable species of paper. In time a texture was developed possessing superior wearing qualities to that already in circulation, but costing very little more. In like manner the national Bureau of Public Roads has conducted a number of tests on roads, with an eye to bettering forest, Indian reservation, park, and Federal-aid highways. And the National Advisory Com-

mittee for Aëronautics has undertaken a series of aircraft inquiries for the prime purpose of advancing Army and Navy flying. Even though the basic goal of a given venture is to promote official progress, the results are usually made freely accessible to the average citizen. As a large proportion of the apparatus and processes surveyed by governments is also employed by private individuals and concerns, this release of data is of general benefit.

Moreover, private parties are not always in a position for conducting extensive investigations. An extreme case is that of agriculture. A farmer who goes to great lengths to improve his technique is apt to find his discoveries being copied wholesale by his neighbors. The only personal protection he can obtain to compensate him for his labors is a plant patent, and such monopolies are granted for but a small range of items. The government, on the contrary, is financially able and glad to make studies for the prime benefit of farmers, being essentially a public servant, and most of the burden of research in this field has therefore been thrown on official agencies.

Many units of government are engaged in research work. Among the Federal agencies so occupied is the Bureau of Standards. Recent investigations made at the Bureau are typified by an inquiry into the effects of the atmosphere on the reflection of radio signals, and another on improved technique for the manufacture of optical glass in this country. The United States Bureau of Mines also occupies itself with scientific inquiries. Picked at random from its list are the following: the relation of mine-gas ignition to the excessive heating of the surrounding atmosphere from electric wiring; geophysical methods of prospecting; means for separating manganese from low-grade ores and gold from mill tailings; and uniformity in lead smelting. Fundamental aëronautical studies have been undertaken by a third body, the National Advisory Committee for Aëronautics. This group has built a unique plant at Langley Field, Virginia,



where is to be found the first wind-tunnel in America capable of testing full-size airplanes. Although it possesses a throat sixty feet by thirty feet in cross-sectional dimensions, air velocities up to 110 miles an hour may be obtained. Also serving as pioneer equipment are its giant seaplane-towing channel and its propeller and variable-density wind-tunnels.

Other units of government operate important laboratories. There are a number of state universities provided with Engineering Experiment Stations, which turn out a steady stream of research reports. For investigations in agriculture, a nation-wide series of Agricultural Experiment Stations is maintained, either as adjuncts to state colleges or as separate institutions. Here a variety of inquiries into insect pest control, crop and livestock improvements, fertilizers, the domestication of foreign plants, and processing technique is conducted. Counties and cities, too, occasionally establish survey bodies to solve special hydraulic or sanitary problems of a local nature.

With so many governmental bodies engaged in research, there is danger of duplication of effort and attendant waste, suggesting vigorous attempts to coördinate the enterprises of scattered agencies in the interests of efficiency. For example, unity in farm investigations has been achieved through the labors of a central office. Under congressional acts, state Agricultural Experiment Stations must accept a measure of Federal supervision as a prerequisite to receiving grants of money from the national treasury. The control thus inaugurated is exercised in a beneficial manner. Care is taken to make sure that Federal and state studies will not openly conflict. Each of the local plants is advised as to the future programs laid out by the others, so that any overlapping can be cleared up before work starts. As a final step, reports from foreign countries are translated and digested, in order that American scientists may save themselves the time and trouble of conducting inquiries that have already been completed abroad.

Governmental experimentation has frequently produced valuable results. In the nineteenth century an agent of the United States Department of Agriculture visited Brazil and brought back the so-called Bahia orange tree. From this parent stock was developed our native seedless orange which spread rapidly over citrous fruit regions, the crop being worth \$35,000,000 in 1920. A second triumph grew out of the visit of a Federal medical commission to Cuba, near the beginning of the present century, with the object in view of finding the cause of yellow fever. After intensive investigation, it discovered that a certain species of mosquito spread the malady from person to person. Others applied the knowledge in striking fashion. Not only was yellow fever ended in Cuba, but it was subdued in the jungles of Panama, by a lively war on the offending insects. The latter success made possible the completion of the Panama Canal with an amazingly small loss of life, as compared with that sustained by the previous French adventurers, who failed in the task. As a third episode, in a wholly different field, the labors of the National Advisory Committee for Aeronautics may be cited. It worked out a new type of cowlings for radial engines which markedly improved the efficiency of aircraft. In recognition of this achievement, the Committee was awarded the Collier Trophy for the most outstanding advance in American aviation for the year 1930. In short, government scientists and engineers have played a prominent rôle in our technological progress.

**How to Obtain Government Reports and Documents.** Owing to the wide range of literature covering the results of technical researches carried on by governments, it is important that engineers and scientists should know how to obtain public reports and documents. As a general rule government officials are glad to answer detailed inquiries put to them on specific points. Published reports may be secured, usually at cost if not free of charge, from the mu-

municipal, state, or Federal department, agency, or establishment in charge of particular functions or investigations. The great majority of Federal publications are handled by the Superintendent of Public Documents in Washington, D. C. Anyone interested in a specialty can obtain from the Superintendent, without cost, a catalogue of Federal materials dealing with the particular subject.

A few hints concerning the use of libraries may be useful. The famous Library of Congress, at Washington, D. C., contains the most complete collection of public documents, state and Federal, to be found in the country. In the large cities certain libraries are designated as official depositories for Federal publications and on their shelves are collections of Federal documents, more or less complete. State and municipal reference libraries, devoted entirely to public affairs, offer facilities for research to private citizens as well as to public officers. Fortunately also, modern library schools provide trained specialists in service for libraries, large and small, and these specialists are always happy to start the beginner in research by indicating comprehensive and special guides to the literature falling within his field of interest, no matter how narrow and technical it may be. If engineers are to take that leadership in public affairs which the importance of their profession suggests they must engage in continuous research in the ever-widening areas of government.



## CHAPTER XIII

### THE REGULATION OF PUBLIC UTILITIES

**Importance of Public Utilities.** Public utilities—water, gas, electric, pipe-line, telephone, telegraph, railway, and bus—constitute a prime class of engineering enterprises. In the aggregate, approximately one-fifth of the productive wealth of the country is invested in them while nearly three million utilities employees annually earn almost four billion dollars in salaries and wages. On the governmental side, this portion of the private business world is of special interest; for utilities are controlled to a higher degree by governmental regulation than any other type of private enterprise. Their rates, their services, their very existence are subject to legislative and administrative restrictions running into minute details. Owing to the unusually comprehensive legal control applied to the utilities, our discussion of the regulatory work of governments may best begin with them.

**Reasons for Government Supervision of Utilities.** Why have the utilities attracted such close attention from the government? The answer lies in certain characteristic traits of the utilities themselves. Engineering necessity forces the utilities to plead for favors from the government. It is imperative that permission to use public property be obtained. Water companies must tear up city streets in order to lay pipes, while electric companies must often cross or follow the public highways with their wires. Furthermore utility concerns must secure the right to condemn private property for sites and rights-of-way. Condemnation is frequently the sole key to success as it prevents recalcitrant landowners from blocking utterly the construction of such vital works as electric transmission lines and railroads. As

the government alone can grant powers of eminent domain, the utilities must bow to authority on this score. The government, in granting much-sought-for favors, can easily attach conditions and in practice it makes use of its strategic position to apply more or less stringent regulations.

There is a second powerful basis for governmental intervention in the utility field. Frequently one utility can operate with better technical efficiency in a given territory than can several competing concerns. For instance a water company connecting every home in a town with its mains can design its system to secure the maximum of service with the minimum of plant and equipment. If two companies tried to serve the same region on a competitive basis, it is more than probable that in certain streets two sets of mains would be found serving alternate groups of houses where technically one main serving every house would be hydraulically superior. The result would be duplication of plant, uneconomical use of pipe sizes, unnecessary capital outlay and unduly high rates. What is true of water is true of electricity and the telephone. The engineering advantages of single systems, however, can only be achieved under monopolistic conditions. The public fears monopolies; fears that they will seize upon their strategic position to charge all the traffic will bear and perhaps more. Consequently if a utility is functioning as a monopoly, in a given territory, the public seeks safeguards in the form of close government regulation.

To summarize: utilities must ask for governmental favors and in return must accept conditions. They must also recognize the public demand for control resulting from the technical need for monopolistic operations.

#### SCOPE OF THE TERM "PUBLIC UTILITY"

**Common Carriers.** Keeping in mind the bases for governmental regulation in the utility field, we might reasonably expect certain general classes of enterprises to come under



*Photograph by Acme Newspictures, Inc.*

### AN EXAMPLE OF DUPLICATION IN PUBLIC-UTILITY FACILITIES

Two rival street-car systems, each double-tracked, fight for business on Market Street, San Francisco. Note the congestion.





close control. The common carriers, using public highways, condemning private lands for right-of-way, and frequently disrupted by wasteful competition, form appropriate subjects for governmental regulation. Railroads were, in fact, among the first to succumb to the authority of the state. Unfair practices, the financial destruction of lines for the profit of a few insiders, bitter rivalry resulting in needless paralleling of routes all added impetus to the movement for rail regulation. The outcome has been that the Federal Government, through its Interstate Commerce Commission, and every state government but one has undertaken to regulate railroads. With the railway precedent before the country, newer carriers of passengers and goods were easily brought under kindred principles of control. Pipe lines, carrying oil and gas, have been designated as common carriers and subjected to regulation in a number of states. The Federal Government has extended its sway to oil pipe lines and has occasionally considered the advisability of regulating gas lines as a future measure. Recently motor buses and trucks, using the public highways and competing with the regulated railroads, have also been classed as public utilities, until at present they are regulated in forty-four states. It is now being suggested that interstate motor carriers be placed under Federal control. Finally telephone and telegraph systems, labelled as "common carriers of intelligence by wire," have been subjected to regulation in forty-five states and by the Federal Government.

**Manufacturing Enterprises.** A second group of public utilities supplies not only the service of transportation but the service of manufacture as well. Systems making or collecting water, gas, electricity, and steam heat and distributing the same by pipe or wire directly to factories and dwellings are uniformly classed as public utilities. With the exception of electricity generated in water-power plants on navigable rivers, this class of utilities is not regulated by the Federal Government. As for the states, forty of them

regulate electric light and power systems, thirty-nine regulate gas works, and thirty-four regulate water companies.

**Suggestions for Widening the Scope of the Term "Public Utility."** Not satisfied with the existing scope of governmental public-utility control, certain groups have suggested its extension into new fields. Facing the evils of high finance, discriminatory rates, and other abuses appearing in the air transportation industry, publicists propose that flying be classed as a common-carrier enterprise subject to government regulation. In view of the fact that all the other major transit agencies are already recognized as public utilities, aviation can hardly hope to escape much longer. More daring is the plan to label certain natural resources as utilities. Bitter labor troubles and wasteful competition resulting in overproduction and general disorganization have become such common features of the coal mining industry as to make some form of drastic action necessary. Consequently Mr. J. D. A. Morrow, one of the large coal operators, has asked that the Federal Government regulate the entire coal mining industry on a public-utility basis. Coming from a captain of industry, the pronouncement is significant. Occasionally similar opinions are heard about the petroleum extraction business. If public temper and the attitude of the courts should support such moves, the scope of the term "public utility" would be indefinitely expanded.

### SERVICE REGULATIONS

**Relation between Rate and Service Regulation.** The great present, and possibly the even greater future, scope of the term "public utility" makes it necessary for the engineer to acquire some knowledge of the substance of utility regulation. Fundamentally the government concerns itself with two problems in the regulation of public utilities. It seeks to control *services*, or the extent and quality of the work performed by the utilities. It also endeavors to fix *rates*, or the charges made to customers. The two prob-



lems are closely allied, for a specific rate is reasonable only when charged for service of a specific quantity and quality. The given rate becomes unreasonable when applied to service of an altogether different quality. It is plain that if a trolley company runs but a few cars during the rush hours, crowding them full of "victims" until the doors fairly bulge, it is not entitled to as high a fare as when it runs several times as many cars, providing seats for nearly every passenger during the rush hours. With this word of caution on the intimate relation between rates and services, we proceed with a separate discussion of the details of rate and service control.

**Permits for the Building of Works.** Governmental regulation of services deeply affects the plans of the engineer. The government controls, in large degree, the building of new utility systems. Sometimes it is the utility which takes the initiative, asking permission of the government before undertaking the construction of rail, electric, or gas lines. Sometimes it is the public, finding the utility adamant to its pleas, that seeks a government order requiring the utility to render the suggested service. Legally it is now settled that the government may compel extensions of electric, gas, and water service subject to certain conditions. If the government is satisfied that a proposed service is worthy of consideration, it may hold hearings to determine the merits of the case. Before a government order or permit will be issued, as the circumstances demand, several points must be proved. It must appear probable that the enterprise will be able to pay expenses within a reasonable length of time. It must also be proved that the project is not intended to duplicate wastefully the facilities offered by another concern and it must be shown that the service will meet a genuine public need. The student should be familiar with two terms covering such permits. Local grants commonly bear the name of franchises and entitle holders of privileges to use the city streets. Grants made by the state are usually known

as certificates of public convenience and necessity and are intended to prevent useless competition.

An important feature of almost every permit for the opening of a new utility service is the proviso controlling the length of life of the instrument. In the past, concerns often succeeded in winning operating rights either in perpetuity or covering very long periods, such as 999 years or so. This arrangement proves unsatisfactory, for as the years pass and the service offered by a specific company is seriously altered, revisions may be unobtainable. To overcome the errors of the older method, modern grants frequently contain a stipulation to the effect that the government may, at a future date, take over or "recapture" the utility systems in question, upon payment of just compensation to the owners. The government may either operate the newly acquired ventures itself or dispose of them by transfer to other operating organizations. The scheme is supposed to place utilities on their mettle. The better they perform their allotted tasks the longer their rights will last, and *vice versa*. The "recapture" date varies in the different plans. Sometimes an indeterminate permit is issued, providing that the government may take over the property involved whenever it may so decide. An alternative method is to allow the utility a trial period of five, ten, or more years during which the permit is not revocable. At the end of the breathing spell, companies proving themselves worthy may be granted renewals of their permits. Judicious wording of the phrases governing the length of life of permits is vital to the future progress of utility regulation.

**Abandonment of Facilities.** Companies seeking to abandon utility systems before the termination of their permits must follow a special procedure. When a railroad company, for instance, plans to discontinue a line, it must petition the proper governmental agency. That agency proceeds to hear testimony relative to the issues at stake. Several factors are considered; these may be illustrated. The Delaware and

Hudson Railroad sought to stop service on its Plattsburg-Ausable line in New York State. The railroad explained that this line carried an average of not over two passengers per trip, and that one train ran the equivalent of 2,000 miles without a single passenger. The brief submitted by certain train users pointed to the poor time schedules as the cause of the slight amount of business on the line. This brief contended that if morning and afternoon trains were run both ways, the people along the line would gladly use them for shopping purposes but that the existing schedule prevented such use. If, after duly weighing the various arguments, the desirability of abandonment is apparent, then a government permit authorizing the discontinuance of service may be issued. This process of study protects areas from being subjected to sudden and arbitrary terminations of service. In the aggregate, abandonment proceedings are of considerable moment. Between 1920 and the latter part of 1927 the Federal Government allowed the railroads of the United States to drop over 4,000 miles of track. The exhaustion of natural resources along the line or the competition of motor cars formed the chief bases for discontinuance.

**Elimination of Duplication.** Utility regulating bodies are not only interested in construction and abandonment; they are also interested in eliminating needless duplications in existing facilities. Often improvements in this direction can be secured through the consolidation of competing companies. To guide the merging process in detail, governmental agencies generally forbid combinations to take place until after formal review. When an interstate telephone line, for example, wishes to absorb an independent concern, it must secure the consent of the Interstate Commerce Commission. During the year ended October 31, 1930, the Commission authorized thirty-nine mergers and banned only one. Government supervision of the consolidation of companies extends to other utilities besides the telephone, reaching rail-



roads, electric plants, and corresponding concerns. The most comprehensive new program of integration is the recently announced proposal of the Interstate Commerce Commission for the consolidation of all the railroads of the nation into a few major systems.<sup>1</sup> However, the prevention of duplication in plant need not involve actual absorption of one company by another. The Interstate Commerce Commission follows a different design when it authorizes or directs one railroad company to make use of the terminal facilities of another railroad company. The resulting unity in use of terminal facilities does not destroy the identity of the participants but it does halt unnecessary expansion of plant.

**Standards of Quality for Services.** The quality, as well as the extent, of utility service is the subject of close government scrutiny. In 1923 half the states had adopted standards for gas service, twenty-three had standards for electric service, ten had standards for water service, six had standards for central heating, and two had standards for telephone service. The object of these standards is twofold. They serve to protect the consumer against inferior service and they form a positive base for rate-making. At the same time there is an element of danger in standardization. If the standards become too rigid or place undue emphasis on certain matters, to the neglect of others, they can easily hamper progress in engineering design. The goal of wise service standards, then, is to steer a middle course, helping the consumer but not unreasonably burdening the utility engineer.

**Gas Standards as an Example.** The general type of detail covered by public-utility service standards may be illustrated by reference to the manufactured-gas industry. The standards evolved for manufactured-gas service touch upon four major items—heat content, pressure, sulphur content,

<sup>1</sup> On December 13, 1933, it was announced that a special committee, under the direction of President Roosevelt, had prepared a plan for consolidating all communications in one corporation under government supervision, and that the plan would soon be presented to Congress for legislative action.

and metering. The amount of heat that can be obtained from a cubic foot of gas is a direct measure of its value for cooking, house warming, and similar thermal uses. Such being the case, the consumer wishes to be sure that, when he pays so many mills per cubic foot for gas, he is obtaining a commensurate quantity of heat from each cubic foot purchased. It has therefore become the standard practice for government regulatory bodies to prescribe a legal heat value for units of manufactured gas. In Pennsylvania the rule calls for gas containing an average of 520 British thermal units per cubic foot. Companies failing to adhere closely to this figure are penalized.

It is important that gas of satisfactory heat content be delivered at proper pressure. If the pressure is too low, the consumer cannot obtain a sufficiently large flow of gas from his appliances to enable them to complete their work properly in any reasonable length of time. On the other hand if the pressure is too high, the moment a fixture is lighted a dangerously large flame will shoot out, a difficulty that cannot be overcome without a wasteful degree of throttling. There is, of course, a happy medium in pressures—a range in which best results are secured, and utility commissions have frequently issued orders making it mandatory for gas companies to keep their pressures within this ideal range. A minimum head sufficient to balance a one and a half inch column of water and a maximum head capable of balancing an eight-inch column of water have been adopted as the legal limits for working pressure in a number of places. On a par with proper pressure is the need for steady pressure. If a gas fixture is adjusted to run efficiently at a given head, it will operate at lower efficiency if the head should change, resulting in extreme cases in the flame flashing back into the supply pipe and going out altogether or in the deposit of excess soot. To further the interests of the consumer government regulatory bodies have, therefore, sought to limit permissible fluctuations in pressure. A maximum

variation of not to exceed 50 per cent from the average is allowed by law in many localities.

Service standards for gas cover two other items besides heat content and pressure, namely sulphur content and metering. In most cases government regulations permit the presence of only a minute amount of sulphur, one typical rule specifying a certain content of sulphur per hundred cubic feet of gas plus a trace of hydrogen sulphide. Furthermore, the consumer is protected by orders insuring that gas meters will be kept in the best of condition. In case a gas meter is thrown so far out of adjustment as to work with an error of over two per cent, it must normally be replaced with a better meter by the utility concern involved. To enforce the law as to the accuracy of meters, periodic tests are usually prescribed.

#### RATE REGULATION

**Unfair Discrimination in Rates.** Services, of whatever quality, must be paid for in accordance with government-controlled rate schedules. These schedules seek to prevent unfair discrimination by providing for uniform rates to all customers receiving a given service. By such means the utilities are inhibited from using their monopolistic powers for purposes of favoritism. This can be demonstrated. When a railroad company charges a manufacturer fifteen cents per hundred pounds of liquid product, sent from Cincinnati to Pittsburgh, at the same time that it is charging another manufacturer eleven and a half cents per hundred pounds of the same substance carried the same distance, the effect is to injure one company and help the other. The Federal Government finds this action discriminatory and orders the railroad to bill both manufacturers alike.

But restrictions on discrimination do not prevent utilities from charging different rates for different services. In fact, under Federal law, interstate telegrams have been classified into day, night, repeated, unrepeated, letter, commercial,



press, and other types. Divergent rates are charged according to the nature of the service rendered. For instance, full rates are quoted for regular day telegrams. At night, when business is slack, telegraph companies encourage traffic by making special rates for "night letters." In the same way, varied rates are paid by railroad travelers for day-coach, chair-car, or Pullman-sleeper accommodations. Where all customers using any one service are charged alike, there is no discrimination, but service classifications must be reasonable.

**What Is a Fair Rate of Return?** Rates must not only be designed to afford equitable treatment to all customers; they must be just and reasonable as well. It is self-evident that excessively high rates may enable a public utility to earn undue profits at the expense of the public it was created to serve. It is equally evident that if rates are too low, the utility may become bankrupt and be forced to cease rendering proper service—an equally unfortunate result. Rates, therefore, to be just and reasonable, must strike a happy medium. They should be little more than sufficient to permit the utility to pay a rate of interest on its stocks and bonds that will attract all needed capital. In practice, government regulatory bodies ordinarily fix the rates at a point to yield a return of somewhere between six and nine per cent on the value of the utility system involved.

Despite the best efforts of government regulatory bodies, the element of competition frequently prevents utilities from earning fair returns. Suppose we consider two rail lines running from Chicago to Seattle. The Interstate Commerce Commission, in fixing rates, prescribes a single charge for freight haulage between the two cities, regardless of the company involved. Now it is indisputable that the cost of hauling freight over both lines cannot be the same. Inevitably there will be differences in gradients, in the frequency and sharpness of curves, in total distance, in equipment, in construction expense and in other items which

will bring the cost of carrying goods over one right-of-way above the cost of carrying the same articles over the other right-of-way. Both rates being the same, one railroad is bound to earn a larger return than the other. Statistics covering the profits of Class I railroads for 1928 illustrate such inequality in a dramatic fashion. Five lines earned over 11.5 per cent profit, 27 earned from 6.5 to 11.4 per cent, 58 earned from 3.5 to 6.4 per cent, 44 earned from 0.4 to 3.4 per cent, and 15 earned less than 0.4 per cent. As a partial remedy for the difficult situation, the Federal Government once tried a unique experiment. It provided that half of all the profits, in excess of six per cent, earned by an interstate line, must be turned over to the Government, the money so "recaptured" being used in helping the weak railroads unable to earn a fair return. In the years 1920 to 1928 the railroads paid \$8,607,000 to the Government under this system for redistributing profits. But even this bold attempt did not solve the problem of enabling each of several competing companies to earn the same fair return, and it was abandoned in 1933.

**Rewards for Efficient Management.** In adjusting public-utility rate schedules to the point where they provide a fair return, attention should be given to the factor of efficiency in management. It cannot be denied that if a concern is permitted to earn eight per cent on its fair value, regardless of how efficiently or inefficiently it is run, there is slight incentive for improvement. On the other hand, if rates are varied to yield a high return under good management but a relatively low return under poor management, the utility is encouraged to strive for operating efficiency. Unusual efficiency was recognized as deserving of reward in the case of the City of Milwaukee *vs.* the Milwaukee Gas Light Company. The Wisconsin Railroad Commission said: "It appears that the so-called 'booster system,' a system of high pressure transmission of gas developed by the respondent in the instant case and installed by it in place of the ordinary

low pressure system previously used, has resulted in some saving of investment for the utility. It seems reasonable that the unusual skill and foresight exercised by the utility should receive some reward." The reverse effect, a denial of reward where management is poor, is evidenced by a decision of the California Railroad Commission in a local trolley case. "An increase in fares," said the Commission, "might possibly be avoided if the engineers' recommendations were carried out and the management and operation of the system put on an efficient and economical basis." The Commission estimated that a saving in operating expenses alone of between \$800,000 and \$1,500,000 a year could be secured by better management. The engineer, then, finds that his skill is not applied in vain in the utility field, under the most advanced types of regulation.

**Rate Bases.** Public-utility rates are intended to yield a fair percentage return on the "fair value" of the plant involved, efficiency in management being a factor. But the term "fair value" is highly ambiguous. Not one but several "fair value" bases appear simultaneously in utility literature. First of all there is the original cost base. In a number of instances the fair value of a utility is regarded as synonymous with the original cost of the plant, less depreciation to date. Where careful records are kept during the course of the construction of a system and where there is enough accumulated engineering experience to admit of proper depreciation calculations, this base may be applied relatively easily. However in the case of some of the older utilities, such as the early railroads, the original records of building costs, even when accurate, have been long since lost. Faced with this predicament in its valuation of American railroads, the Interstate Commerce Commission has adopted a second base, that of reproduction cost. The Commission has estimated what it would cost to rebuild the existing lines at 1914 prices. From this quantity it subtracts depreciation to date. The result is reproduction cost less depreciation.



Several combinations and variations on the two above bases are to be found. For example, "the prudent investment" of a utility company in its plant and equipment, rather than the total original cost of the same, may be taken as a rate base. And again some weight may be given to original cost and some to reproduction cost in order to arrive at a combination rate base.

The proper selection of a rate base has a profound influence on the returns that may be earned by a given utility concern. For instance, in a Nebraska rate case the Union Pacific Railroad sought permission to earn a fair return on the original cost of building its line through the state. This original cost was comparatively high, amounting to some \$103,000 a mile, for pioneering conditions attending the construction of the very first line of rails to cross the state, coupled with wastes due to the great haste with which the job was done, contributed to raising costs. Opposing the Union Pacific claim, various groups in the state suggested that reproduction cost should be used as the rate base. They pointed out that a new line could be built for \$30,000 a mile, according to an estimate made by state officials. Comparing the two contentions, it is evident that the railroad company would be entitled to rates three times higher on the original-cost valuation of \$103,000 a mile than it would if limited to the reproduction-cost valuation of \$30,000 a mile. Shippers would be blessed with much lower freight rates on a reproduction-cost base than they would on an original-cost base. The line-up of interests is clear and much might be said in favor of either side. The railroad company argued that it had spent \$103,000 a mile to open up the region and was entitled to pioneering rewards. The shippers declared that they could build a new line at a third the cost and they did not see why they should reward the owners of a more expensive pioneer line. This episode affords a foundation for a general law: utilities profit most from original-cost valuations when prices have fallen, while they profit

most from reproduction-cost valuations when prices have risen.

**Revision of Rates.** Whatever the original basis for a given rate may be, that rate should be revised from time to time as prices change. For instance a rate that yields a fair profit to a steam-electric generating plant when coal is selling at a certain figure will, other things being equal, yield too low a return if the price of coal should suddenly soar and too high a return if it should drop precipitously. As an alternative to the customary periodic revision of rates by governmental agencies, with its attendant lengthy delays, the service-at-cost system has been evolved. As applied in Cleveland, Ohio, the local street railway company was ordered to set up a reserve fund of \$500,000. All company earnings were added to the fund; and all company expenses, including the statutory six per cent return on the investment, were subtracted from the fund. Since the company was allowed to remove its legal six per cent return from the fund continuously, the fund would swell whenever the net revenue exceeded six per cent and the fund would shrink whenever the net revenue was less than six per cent. To take advantage of this situation, the law provided that whenever the fund grew to more than \$750,000 under a given rate schedule, fares were to be automatically cut one "grade," to a predetermined lower level. If the fund, however, shrank in size, falling below \$250,000, fares were to be automatically raised a "grade." By this arrangement, rates were to be periodically adjusted so as to enable the company to earn, if possible, a steady return of six per cent at all times—no more, no less. A government officer was appointed to supervise the system and insure fair play. This service-at-cost scheme, it would seem, offers the ultimate in flexibility.

**Control over Security Issues.** Intimately associated with the regulation of rates and services is government control over the sale of securities. Formerly, in the absence of official restrictions, utilities frequently issued obligations

bearing an aggregate face value considerably in excess of the amount of money ultimately received and spent on plant and equipment. That is, a concern with an outstanding debt of \$1,500,000 might have \$1,000,000 or less invested in actual works. This result could be brought about in any one of several fashions. Occasionally promoters were given limited quantities of stock at a low price which they disposed of at a handsome figure, pocketing the difference. The company, of course, was left holding the bag, being forced to pay dividends on the excess capital even though it did not receive one cent of cash from the promoters' profit. So, too, bonds might be marketed below par, leaving a mortgage on the property that was only partly secured by permanent improvements. If an enterprise in such circumstances is to remain on a sound footing, attracting further savings with which to expand, it must provide adequate interest on the excessive load. But if rates are fixed at a high level sufficient to cover dividends on a great deal of "water," undue burdens are thrown on the consumer. From his point of view it would be best to cut charges to conform with a fair capitalization and let investors take their punishment. However, there are practical obstacles in the way of such a policy, for the reason that the latter made their purchases in good faith and as innocent parties are entitled to some protection against harm. Nor is the plea wholly sentimental, for harm would make the floating of new loans difficult. In many cases, therefore, customers are sacrificed, past financial errors forgiven, and returns allowed even on excessive capitalization.

Very little can be done by regulation to remedy overcapitalization which is the cumulative product of a series of past financial blunders. But a repetition of the evil can be largely prevented through vesting in governmental bodies generous powers to regulate the issuance of securities by public utilities. Under the most advanced forms of legislation, no long-term bonds, stocks, or notes can be placed on



the market without official permission. Furthermore they can be sold only to raise money for certain definite purposes, such as the acquisition of property, the construction or extension of facilities, or the refunding of older obligations. Lastly, the total amount of a flotation shall not exceed reasonable requirements for the work at hand. If formal approval is obtained by a company for incurring additional debt, it must abide by the terms of the authorization, making offerings at par, or whatever figure is ordered. After the block of securities has been sold, the concern must report to the proper regulatory agency on the use made of the proceeds.

Not only do regulatory bodies specify total values for individual issues approved for sale, but they also control the relative proportions between stocks and bonds. Where an undue proportion of the indebtedness of a given utility is in the form of bonds, bearing a fixed rate of interest, a slight reduction in income may cause a default—shattering credit. But if a proper percentage of the capitalization is in stock, on which periodic payments are not compulsory, then variations in profits merely produce fluctuations in dividends, without necessitating reorganization. Consequently it is frequently required that not over fifty or seventy-five per cent of the securities of an operating corporation shall be in bonds.

Of course official sanction of an issue is not an absolute guarantee that it is sound and, what is more, the government assumes no direct responsibility for defaults. Indeed regulatory bodies do not even promise to fix charges for service at a figure that will afford a fair return on securities approved by them. But the fact that impartial outside administrators have reviewed proposed issues and found them to be legitimate gives prospective buyers increased confidence. A double benefit to the public results: citizens are protected against the worst malpractices in financial circles; and general faith in offerings enables utilities to borrow at

lower rates of interest, thereby reducing their operating expenses to the ultimate benefit of the consumer.

**Control over Accounting Methods.** Inasmuch as the regulation of public utilities involves close investigation of intricate financial structures, it has become necessary to vest in government agencies broad supervision over private accounting processes. Utilizing their powers to the full, many official bodies specify in detail just how the books of utility concerns shall be kept. By standardizing methods, the practice of juggling figures in such a manner as to conceal profits or swell apparent valuations is placed under substantial restraints. Through the additional device of requiring operating companies to file reports at periodic intervals, the proper authorities are automatically supplied with current statistics of a relatively high order. Frequently this material is freely opened to citizen inspection, allowing inquisitive customers to get information.

**Nature of Holding Companies.** Serious regulatory difficulties have arisen as a result of the formation of innumerable holding companies, the bulk of which now remain beyond the reach of state and Federal officers. A public-utility corporation may issue a variety of securities, only a small fraction of which confers upon the possessors a share in the management of the enterprise. Thus the holders of \$100,000 worth of stock in Corporation A, capitalized at \$1,000,000 altogether, may alone be entitled to vote on the election of officers and on policies. If Corporation B should get control of \$50,100 worth of this stock, it would have a majority at directors' meetings and could dictate a program of action for Corporation A. The process can be continued indefinitely. Corporation C may acquire stock in B, and D may corner the stock of C, thus securing the power to control the actions of A, B, and C. Financial "geniuses" may, through this subtle device, sit at the head of vast aggregations of scattered undertakings even though backed by very slender funds. In fact one concern, with a total investment of less

than a million, dominated a string of subordinate units whose combined value was \$370,000,000.

**Importance of Holding Companies.** Holding companies have won a prominent position in the public-utility industry. Three-quarters of the electric energy generated in the United States, in 1924, was produced in plants directed by such combines. Largest of all power organizations was the Electric Bond and Share Company, controlling twelve per cent of the output in the United States through a series of lesser regional bodies. Five of the most important of the latter, in 1925, managed nearly 200 subordinate units, scattered over at least thirty states. Dominating the wire communication field is the American Telephone and Telegraph Company, also deriving much of its strength from pyramiding stock ownership. Among the principal enterprises in the water-supply business, in 1930, were the Federal Water Service Corporation, with fourteen main operating agencies, and the American Water Works and Electric Company with forty-two. Moreover the trend seems to be definitely toward greater integration of this type.

**Regulatory Problems Raised by Holding Companies.** Despite their importance as factors in the industry, these combines are substantially free from government interference. The courts have often ruled that even though a holding company determines policies for a string of plants, through ownership of voting securities, the fact that it is not itself engaged in operating equipment divests it of its public-utility character. As a result, ordinary regulatory laws cannot be applied to holding concerns. The little authority exercised by official agencies is wielded in a round-about fashion. A few localities, for example, require all holding companies to obtain formal permission before purchasing the stocks of local enterprises. In the remaining cases states merely try to pass upon the reasonableness of the charges made by the former to subsidiaries for services rendered, as a means of checking up on legitimate expenses



for rate-making purposes. Here, however, grave difficulties are encountered. Generally the statements of private executives have to be taken at their face value, for an Indiana public service commission, let us say, cannot force a directing staff in New York to bring its ledgers to Indiana in order that the propriety of fees may be reviewed. In short, state supervision of holding companies is very weak, while national intervention has not yet been attempted.

A holding corporation may render a variety of managerial services to its operating subdivisions. Frequently one of the major auxiliaries of such a corporation is a construction outfit, used in installing apparatus for member organizations. Supplies, such as coal, wire, and transformers, are commonly purchased by a central agency for the rest, at wholesale prices. A staff of experts at headquarters prepares plans, or formulates policies which are made obligatory on subordinate enterprises. Isolated electric equipment is joined in super-power nets, through elaborate intra-company contracts. Finally, the main office may borrow money for component groups in large lump sums. Representative of the fees set for such activities are those of the Electric Bond and Share Company for 1927. Its subsidiaries were billed from one and six-tenths per cent to two per cent on their gross earnings for general service, an extra amount for engineering in connection with plant design, and from four per cent to five per cent on new construction. Owing to the multiplicity of items, and the freedom of holding aggregations from state regulation, there is ample opportunity for altering apparent profits by juggling accounts, without getting into legal difficulties. This shifting of figures is not, however, necessarily in the consumer's interest. Here is an unsolved problem in governmental supervision.

#### REGULATORY BODIES AND THEIR PROCEDURE

**Units of Government Regulating Public Utilities.** The formulation and enforcement of rate and service regulations

are carried on by several units of government. Municipalities were among the first to enter the field dealing with gas, water, electric, and telephone systems, at an early date. Today local regulation continues in places, but superimposed upon it is the much more powerful regulation emanating from state governments. An important factor in the development of state utility regulation has been the great increase in the service area of public utilities resulting from technical advances. The building of extensions to railway lines, the construction of long-distance repeater telephone circuits, the interconnection of electric systems into super-power nets, the piping of natural gas for long distances, all demand attention from state bodies, with spheres of operation extending far beyond the confines of any one city. In cases involving interstate commerce, Federal regulation has been added to state and local regulation, with the problem of expanding service areas once more a prominent factor in the movement. The Interstate Commerce Commission of the Federal Government, supervising interstate railroads, telephone and telegraph systems, and the Federal Power Commission, in charge of hydro-electric plants on navigable streams and on public lands, have the nation as their domain.

**Utility Commissions.** According to long practice in the United States, governmental agencies concerned with utility regulation are generally of the commission type, that is, bodies composed of three or more members—in the case of the Interstate Commerce Commission, of eleven members. In some cases state commissions are elected by popular vote, and in others they are appointed. Whatever the method of selection, political considerations usually enter, and an effort to balance forces may result in the requirement that no more than a bare majority of members shall belong to one political party. Among the state commissions there is great variation in the quality, powers, and status of membership. In a few states, commissioners are paid attractive salaries, endowed with large authority, and supplied with competent

engineering and accounting staffs; but this is far from the general rule. It is not too much to say that in a majority of states utility commissions are not competent, in quality of membership, powers, and equipment, to discharge adequately the difficult tasks imposed upon them. Indeed, commission regulation is now under a running fire of criticism based in part upon the weaknesses of membership and dilatory tactics in operation.

**Commission Procedure.** Commission procedure usually resembles that of a court. Customers themselves, or governments acting in the interests of the consuming public, may make a formal complaint to the commission serving their territory, whenever they feel injured by the policies or charges of any utility concern. On receipt of a formal complaint, protesting against existing rates and services, the commission makes a brief investigation to see whether the petition warrants further consideration. When the application for relief seems, after examination, to possess real merit, the commission serves notice on all interested parties that public hearings are to be held. At the hearings, testimony is heard both for and against the existing rate and service arrangements. At the close of the hearings, with the facts before it, the commission deliberates on the matter and renders a decision. If any mandate of the commission is ignored by the utility, punishment by fine or damage fee or by the imprisonment of officers may be visited upon the concern.

One great weakness in this mode of trial lies in the fact that the average citizen, or his representative, does not always feel like going to the time and trouble necessary to file a complaint against utility rates and services. To remedy this state of affairs, regulatory commissions have often been granted the power to begin proceedings at any time on their own initiative; they do not have to wait for formal outside complaints. When action is taken upon the motion of a commission, hearings are held and decisions rendered just as if the consumer had started the ball rolling.



**Judicial Review of Commission Decisions.** Appeals may be taken to the courts, from the decisions of utility commissions, whenever points of legal competence or constitutionality arise. In practice such questions appear so frequently as to transfer to the courts a large share in the regulating process. The Constitution of the United States protects utilities, among others, from being deprived of their property without due process of law. Now any schedule that yields a company too low a rate of return or places an unreasonable valuation on its equipment, with resultant financial injury to the concern, amounts to an unconstitutional interference with its property rights. Every rate system being different, as to time, plant, place, or other details, the courts do not attempt to set up general rules but prefer to examine each new situation on its own merits. The net result is that the courts are constantly passing on the validity of commission orders, supplanting them where necessary with judicial edicts. So much for the legal justification of judicial intervention.

One serious result of court action relative to utility matters is a lack of uniformity in judicial decisions from case to case, and from state to state. In one instance the United States Supreme Court declared a six per cent profit to be reasonable, while in another it specified seven per cent as a minimum fair return. As for rate bases, varying emphasis is laid on original cost, reproduction cost, future prices, and a host of other items depending upon circumstances. Since the courts fail to agree on a single rigid continuous rate policy, the commissions live in constant awe of the judiciary, realizing that it is the courts which are in real control of the utility rate structures and practices.

**Expense and Delay in Utility Proceedings.** The process of rate and service regulation, involving as it does numerous surveys, public hearings, and court appeals, consumes a great deal of time. According to one study made of the situation in Pennsylvania, the average period required for the

settlement of rate disputes before the state Public Service Commission was almost two and a half years. The Pennsylvania Gas Case remained active before the Commission for four years and one month, and then it went on appeal to the courts for two years more. The Ben Avon Water Case was before the Commission for two years and three months and before the courts for four years longer. A case involving the Philadelphia Suburban Gas and Electric Company was in the hands of the Commission for four years.

The major retarding factor appears to be the necessity for making elaborate opposing inventories of every pole, every foot of wire, every cross-arm, every machine, every bolt and nut owned by a utility in order to arrive at a "fair value." In the Pittsburgh Railway Case, the company contended for a value of \$70,000,000 while the city held out for \$48,000,000. The analysis of the differences between the rival claims was naturally a complicated matter. Before the dispute could be terminated, two and a half years of effort had been devoted to appraisals, the Commission compromising on \$62,500,000 as the proper value. Again, in the Reading Transit and Light Case, three different concerns made three successive appraisals of the property, helping to drag the litigation out to three years and eleven months. Utility regulation is far from being a rush affair.

Proceedings of such duration are inevitably expensive. Fighting for their lives, utilities are frequently willing to put up larger sums to win rate cases than is the public. For example, in the Philadelphia Electric Case the utility spent \$286,000 while the public spent \$42,000. In the Wilkes-Barre Railway Company rate dispute the utility spent \$35,500 while the public spent \$3,300. In the Pittsburgh Railway Case the company opposed \$400,000 to the \$125,000 available on the public side. In the Philadelphia Rapid Transit Case the company laid out \$600,000 to fight the \$250,000 put up by the public. Disparity of this nature may inure to the disadvantage of the consumer.

**Impartiality of Experts.** The representatives of the public are hampered in a second respect—by the difficulty of securing competent experts. The great majority of the experts in the utility field are, as one might expect, employed by private companies. It would be strange indeed if these men were to turn around and bite the hand that feeds them. As a consequence, cities and other public organizations engaged in rate disputes find it hard to secure the type of expert who will oppose utility concerns with competence and vigor. In the Pennsylvania Gas Case, the city solicitor of Erie, Pennsylvania, unburdened himself on this matter as follows: "We combed the field to get experts or witnesses who would appear on the public side, regarding the value of gas lands. . . . Nearly every gas engineer, operator or driller in this section was either employed by or affiliated with some natural gas company, or had a contract or lease from such company, and was unwilling to testify for the city."

**Rationality and the Engineering Expert.** Whatever political and private considerations may enter into the actual utility controversies, engineering rationality is bound to ignore them. It is clear that public utilities are engineering enterprises employing materials and energy measurable in mathematical terms and rendering services measurable in the same terms. Here are "deterministic sequences," as they are called, with which exact science can deal, from which it can and is bound to exclude emotional and other irrelevant forces. Here it is possible as well as desirable to arrive at the kind of positive conclusions known to exact science. If engineering experts will not, for personal or other reasons, render accurate and reliable services in utility controversies, then it is incumbent upon engineering schools and engineering associations to promote the talents required by the integrity, rationality, and precision of their science and profession. Otherwise technology will not attain the position in American society to which it is entitled



by virtue of its intrinsic powers but will become the servant of whims and passions—the mortal enemies of rationality.

**The Public Ownership Movement.** The high costs of legal contests before regulatory commissions and the courts, the difficulty of securing impartial experts in engineering, the extraordinary profits made by some utility concerns and their bankers, the huge losses suffered by the public from investments in utility stocks, and the practices of many utility concerns in carrying on propaganda (revealed in thousands of pages of testimony taken by the Federal Trade Commission) have given great impetus to a movement in favor of government ownership and operation in the utility field. Concerning the political merits of this dispute, engineering rationality as such can enter no scientific verdict. If called upon to do so, technology could make a survey of the entire utility field and indicate the physical plant set-up and interconnections best calculated to furnish the quality and quantity of service desired at the lowest cost in terms of physical units. But so many conflicting interests are involved in the contest—local, municipal, state, and Federal politics on the one side and competing utility politics on the other—that no such purely objective and scientific survey has been made. Doubtless it would contribute to a clarification of the issues if the tables were reversed, if engineers should divest themselves of theories and passions associated with political and economic conflicts and study the utility problem in the light of pure engineering efficiency; that is, the attainment of the objectives of utility operation at the lowest cost in physical terms. In this case, new light would be thrown on the endless political and economic squabbles in the utility field and some guidance would be furnished for considering the substance, as distinguished from the collaterals, of the matters in dispute.

## CHAPTER XIV

### PATENTS, COPYRIGHTS, AND TRADE-MARKS

Engineers operate in a technological society built to a large extent upon three types of monopolies granted by the Federal Government—patents, copyrights, and trade-marks. Few individuals or companies are willing to risk placing articles on the market without such protection, if it can be obtained. In fact it has been estimated that seven-eighths of our industrial enterprises are dependent directly or indirectly on patents, or were originally founded to exploit them. Rarely indeed is there a technical text or trade magazine that is not copyrighted. Thousands of calculating charts, aerial photographs, and motion picture films are protected by copyrights. The products of great concerns—Ford, General Electric, Westinghouse, the Radio Corporation of America, and General Motors—are invariably stamped with trade-marks. Wherever the engineer turns, he comes across signs of governmental activity in the patent, copyright, and trade-mark fields.

#### THE PATENTING PROCESS

**Purpose of the Patent System.** Experimentation must be encouraged or society will suffer from engineering stagnation. In practice a very strong stimulus to research is provided by the Federal patent system. The discoverer or inventor of a new device is granted a seventeen-year monopoly over its use. In this length of time, it is believed, he should be able to earn a fair return for his labor, since all other persons and concerns are legally estopped from exploiting his idea without his consent. The need for secrecy is banished. Creative design is rendered advanta-

geous in a commercial sense. At the same time the interests of the public are not lost to sight. The new idea is opened to inquirers in full through the patent records; the state of the technical arts is thus made continually apparent. It is true that during the seventeen-year period business in general may be hampered by excessive prices and various forms of monopolistic practices, but at the close of that term, free and open competition in manufacture is established. So, it is argued, the privileges granted to the inventor will not be far out of proportion to his contribution to the public as a whole. To inspire and protect inventive genius without placing undue burdens on industry and consumers is supposed to be the real purpose of any patent system.

**Parties Eligible to Take Out Patents.** Assuming that an engineer has worked out a new invention and wishes to secure protection for it under the American patent system, how should he proceed? To begin with, he may wonder whether the law allows him to file papers. Fortunately for him the object of existing legislation is to encourage invention. Consequently very few personal qualifications are imposed on patent applicants. Men or women, minors or adults, citizens or aliens, joint discoverers acting together or separate individuals may present their claims. Furthermore, the mere fact that unsympathetic friends cast doubts upon an inventor's mental state is not an insuperable barrier to his success, since the statutes permit even those adjudged insane to enter claims through their guardians.

**Patentable Types of Discoveries.** If an inventor is personally qualified to file an application, he must next make sure that his discovery is patentable. Again we find existing legislation very liberal, permitting the granting of exclusive rights to the following items: (1) *Processes*, such as those for making soap, extracting gold, tanning leather, or for photo printing; (2) *Machines*, such as typewriters, lawn-mowers, and dynamos; (3) *Formulas*, for new chemical compositions,



such as artificial rubber, paint, cleaning fluids, cosmetics, cements, metal alloys, or gunpowder; (4) *Manufactures*, including almost everything not comprised in the above classes, such as barbed wire, or bottle caps; (5) Under a recent statute, *Original Biological Plants*, produced by grafting or selective breeding, are on the list of innovations for which protection may be secured.

**Device Must Be Useful.** Although a discovery falls within the above classes, it must be useful; otherwise a valid patent cannot be issued. In other words, if an individual has an almost but not quite workable scheme in mind, he should continue to develop it until he has overcome all obstacles in the way of its actual utility before he attempts to file papers. To be specific, a patent covering a locomotive spark arrester was once declared void because, although it did stop the sparks, in the process it practically stopped the locomotive as well. However the restriction with respect to utility is not a serious one, for a monopoly on an article that did not serve its purpose effectively would be futile anyway.

**Inventions Must Be Original.** Since the purpose of the patent system is to reward only creative minds, the Government will not ordinarily grant monopolies to those who merely rediscover old devices. Perhaps a description of a contrivance has appeared in full in a book or magazine, possessing a circulation sufficient to make it reasonably well known; or somebody has already taken out a patent on the invention in question; or it has been put to actual use, not merely in the presence of a few observers, but in public demonstrations. In such circumstances an application for a patent is doomed to failure.

**The Patent Application.** When an inventor is reasonably well satisfied that he has an eligible invention, the next step for him is to file a formal application with the Patent Office of the Federal Department of Commerce, located at Washington, D. C. The papers open with a petition requesting the Government to grant the desired monopoly. Next follows a

detailed statement on the contrivance, and how it operates. This description must be clear and complete, for if any part is unintelligible or inadvertently omitted, the presumption is that the design is also defective and unworkable. Accompanying the general account are numerous claims—each being a declaration respecting some element of novelty that the device is thought to possess. Care here is essential, too, for the value of the patent, when finally issued, depends upon the nature of the contentions advanced. They must not be so broad as to conflict with prior claims nor so narrow as to allow others to achieve almost identical results by ingenious variations of plan. Drawings of machines must be prepared as well as general descriptions. In complicated or doubtful cases models may be required, but ordinarily they are not necessary. Finally an oath must be taken expressing the belief that the applicant is the real originator of the device in question. A fee of twenty-five dollars plus one dollar for every claim in excess of twenty is charged by the Patent Office to defray the administrative expenses incurred in looking over the documents.

**Examination and Amendment of Application.** Papers received in proper form are distributed among the various divisions of the Office in accordance with the character of the devices involved. Upon their arrival at the appropriate divisions, examiners compare them with descriptions of articles previously patented in the same class. If the novelty asserted in every claim attached to a given petition is upheld on inquiry, then the path is cleared for the prompt issuance of a patent. But if the search reveals points of conflict with previous discoveries, the applicant is notified of the nature of the difficulty. The latter may then either amend his statements so as to avoid such obstacles, or seek to convince the Government that the objections are unjustified. So much for amendments.

**Interferences.** "Interferences" constitute another stumbling block. Where two or more persons claim to be the

originator of a given device, the presumption is that the one who filed the earliest application is the right claimant. However the Government affords the other contestants ample opportunity to point out the fallacies in the contention. In doing this, it declares that the rival assertions "interfere." A hearing is then held, at which witnesses are allowed to present testimony in support of the respective claims to priority, substantially unhampered. At the close of the hearing a "verdict" is rendered. Illustrative of the process is the history of O. M. Morse, who built a dust collector for flour and other mills where fine suspensions in the air create explosion hazards. Instead of trying to secure a patent at once, he decided that it would be best to see first whether there was a commercial market for the apparatus. After finding it easy to sell the product, he prepared a formal patent application. Meanwhile forty-three other claimants had sent their petitions to Washington. Soon the whole group was joined in a single "interference" proceeding. Ultimately Morse convinced the Patent Office that he alone was entitled to the patent, but the burden of accumulating the necessary legal proof cost him thousands of dollars. Such experiences indicate that patent applications should be made at the earliest possible moment, and that, as an added precaution until claims are filed, a continuous record of experimental events should be kept, with a view to confounding opponents in case "interference" trouble develops in due course.

**Appeals from the Decisions of Examiners.** If an applicant has ground for refusing to amend his papers, as requested by the examiner, or loses in an interference proceeding, his privileges of review may be exercised; he may turn to the Board of Appeals of the Patent Office. This body hears the testimony of the applicant and of the Federal agents involved, and on that basis recommends that the claims be allowed, modified, or rejected. Failing to get relief from the Board, the dissatisfied petitioner may turn to the Court of



Customs and Patent Appeals of the District of Columbia, and ask for a review of the case. The decision of this court is final save in exceptional cases. If the controversy is settled in favor of the inventor, the Patent Office expresses its willingness to issue a patent, on receipt of the proper fee, namely, \$25 plus \$1 for each claim in excess of twenty.

**Patent Pending Protection.** Inventors receive two types of protection for their discoveries, the first preliminary, the second final. As soon as a patent application is filed on an article it may be marketed with the label "patent pending" conspicuously displayed. Other manufacturers are not likely to risk copying the device in question, especially if it is complex in nature. The reason is simple; if they should start operations on the assumption that the patent pending will not materialize, the sudden issuance of a patent would force them to abandon their plant and discard whatever stocks of goods were on hand. Finally, at the second stage a patent is issued; the holder then receives the exclusive right to make, sell, and use his invention for seventeen years. It is only human for inventors to wish to forestall competition as long as possible. Since patents as a rule are not renewable, the only way to put off the day of open rivalry is to extend the patent-pending period. As we have seen, the opportunities for delay are numerous. An individual who is slow to answer letters from the Patent Office, who engages in incessant arguments and appeals over claims, who resorts to all the wiles suggested by a skilled attorney, may be successful in increasing the actual duration of his monopoly. Thus on December 31, 1920, there were 145 patents that had been pending for ten years or more, and sixty that were still pending after the lapse of fifteen years. The extreme case seems to be that of one patent application kept alive for thirty-four years, affording its possessor more than a half century of partial or complete safety.

**Transfer of Patents.** The holder or holders of a patent can transfer title to one or more persons or corporations,

just as he may do in the case of other property—that is, by the execution of a written agreement. Where a patent changes hands it is advisable, although not legally necessary, to record the transaction with the Patent Office. Rather than sell their monopolies outright, however, many inventors prefer to lease them. Thus a number of companies may be licensed to turn out the same machine, with the understanding that royalties will be paid in proportion to the quantity sold.

**International Patent Agreements.** American patent holders are now able to secure important foreign patents with facility, owing to the signing of an international convention by the United States, Great Britain, France, Germany, Italy, Japan, Switzerland, and certain minor powers. As the treaty now stands, an inventor may file a patent application in one or more of the signatory countries. For a year from that date, he is fully protected against rival applications subsequently sent to other signatory countries. Inventors are thus given ample time to acquaint themselves with requirements abroad and to draw up the proper legal papers for application to foreign governments.

**Validity of Patents.** Even though the Government ultimately issues a patent, the grant may be eventually found worthless. Confronted by a great rush of applications, Federal examiners in Washington inevitably make mistakes in comparing each with hundreds of items described in printed technical literature, the existing mass of 1,800,000 prior patents, and scattered evidences of public use. These slips are rectified frequently in court. If, for example, a concern can prove that an error has been committed in the granting of a patent to a rival, a judge of proper jurisdiction may void the patent in question and leave its holder completely unprotected. The importance of cancellation proceedings is revealed in the following figures. Between the years of 1889 and 1902 a total of 171,025 patents was granted. The last of these expired in 1919 so that their

histories are now complete. Out of the group 288 were declared to be invalid by the judiciary—approximately a third of the total number that came up for judicial review.

**Infringement.** If an individual or concern attempts to take advantage of a discovery in defiance of the supposed rights of an inventor, the latter can protect himself by bringing suit against his rival in a regular court of proper jurisdiction. Frequently he can obtain an injunction from the judge requiring the allegedly illegal enterprise to cease operations until the termination of the trial. During the legal proceedings, testimony is heard as to whether or not the defendant's design really conflicts with the claims contained in the inventor's patent. The chances of winning a favorable verdict are about even for both sides. Of the 171,025 patents issued between 1889 and 1902, a total of 700 was drawn into litigation; of these, 385 were declared to be infringed and 315 not infringed. If the inventor wins his case, several remedies may be made available to him. Often a permanent court order is issued, forbidding the loser to manufacture the device until the patent expires. Persons disobeying such an edict are subject to fine or other penalties. A more positive award is that of damages. These may be recovered to an amount equivalent to the entire profits realized by the company ignoring the patent. Where there are evidences of bad faith in the bargain, this compensation may even be tripled.

**Patent Attorneys.** From what has been said, it should be apparent that the process of taking out and defending a patent is highly involved. Skilled guidance is, therefore, of substantial help from start to finish. To begin, the best files of periodicals and patents are at Washington, D. C. Inventors wishing to study earlier discoveries in their fields find it advisable either to travel to the capital themselves or to hire an agent there to conduct a search for them. With respect to procedure for drawing up specifications, the United States Patent Office itself says: "An applicant . . . is advised,



unless familiar with such matters, to employ a competent patent attorney, as the value of patents depends largely upon the skillful preparation of the specification and claims." Similarly the process of amendment, appeals from the decisions of Federal examiners, and lawsuits regarding the validity of existing patents or with respect to infringements require specialized attention. Frequently, then, it is wise for a technician to contract for the services of a trained attorney. The major objection to employing an expert is, of course, the additional cost incurred—a serious deterrent in many cases. Fees vary, but one typical set of quotations places the total figure at \$250, including government charges, for covering a simple device. A number of individuals are thus forced to handle matters for themselves.

#### PATENT COMBINES

**Need for Patent Combines.** With the steady growth of technology, patent complications have become increasingly serious. Up to 1931 a total of 1,800,000 patents had been issued in the United States. Frequently a series of patents covers alternative ways of accomplishing a given result. Where the points of similarity are numerous, fertile grounds may exist for infringement litigation among competitors. In any case the absence of monopolistic possibilities reduces the inventors' chances for easy profits. If a company can buy or otherwise acquire the patent systems of its rivals, the expenditures incurred may be fully offset by the resultant freedom from court worries or devastating price wars. Here, then, is one of the fundamental causes for the patent combination movement. Furthermore, purely technical considerations may make the assembly of kindred patent rights imperative. With the shift from simple to complex machines, and the development of highly involved automatic devices, a concern often has to control a multitude of patents in order to turn out all the essential component parts for a finished product. Briefly stated, the inherent nature of modern tech-

nology compels manufacturers to hold and to group related patents.

**Patent Pools.** For very practical reasons, one can see, powerful patent combinations are formed. These combinations may be organized in one of several different ways. Sometimes the holders of related patents place the same in the hands of a common trustee, and thereafter all members of the "pool" are entitled to use any of the deposited rights on suitable terms. An example of the system is to be found in the oil-cracking business. This trade is engaged in breaking down the complex hydrocarbons present in crude petroleum into gasoline and other simple substances. In 1913 the Standard Oil Company of Indiana obtained patents on the original process. The president of the organization thus described the results: "When other processes were perfected in 1921 claims of infringement were set up and each owner of a process threatened suits against the others. The amounts involved were so enormous that cracking would have been impossible because of fear of liabilities for infringement. All companies concerned agreed to license each other to use the processes. It assured plentiful production on reasonable terms. It was a sane and sensible business settlement." The corporations involved were the Standard Oil Company of Indiana, the Standard Oil Company of New Jersey, the Texas Company, and the Gasoline Products Company.

**Patent Consolidations.** Consolidations constitute a second type of patent combination. The term is applied to cases in which a single concern purchases most of the important patents in its particular field, thus obtaining a virtual monopoly over an entire industry. A typical instance is that of the Indiana Manufacturing Company which acquired 100 patents on wind-stackers at a total cost of \$600,000, in addition to royalties. When an organization of the consolidated variety has secured the basic rights to the parts of a machine, it is in a strategic position to strengthen itself. Owners of

improvement patents frequently find it difficult to market their new attachments without the legal permission of, or technical coöperation from, producers of the fundamental apparatus. Refusal of assistance, in this connection, may force innovators to dispose of their patents at low figures.

### **Influence of Anti-Trust Laws on Patent Combinations.**

As we have just seen, there is a tendency towards the organization of patent combinations. Diametrically opposed in principle is the concerted drive conducted against monopolies on the ground that they are contrary to the public interest, destroyers of free competition, which many believe to be the life of trade. This animosity towards large-scale business finds political expression in numerous Federal and state anti-trust laws (Chapter XVIII). Inevitably there are clashes between the enforcers of anti-trust statutes and the leaders in the patent combination movement—contests that are constantly being carried into the courts.

When faced with the necessity of resolving conflicts in specific cases, courts recognize that a patent constitutes a perfectly legitimate monopoly over a particular device. Nor do they object to a party's buying a series of these rights, just as it might purchase land or buildings. But the moment an organization succeeds in acquiring so many related patents as to restrain trade unduly, according to the judicial mind, it may be broken up as a violator of the anti-trust statutes. It is impossible closely to define, in the abstract, the critical point at which a patent combination becomes illegal, but illustrations may serve to indicate the guiding principles.

Four separate devices to prevent doors from banging were invented—each covered by its own distinctive patents. A corresponding number of manufacturers undertook to produce and market these so-called liquid door-checks on a strictly competitive basis. In time a move was started to join them all together, creating a virtual monopoly over the entire door-check business, and putting an end to internal strife. As a result, all rights were pooled in a single unit,



with complete control over the specialty. Soon the legality of the combination was questioned in the courts on the ground that it violated the anti-trust laws. Obviously trade was being restrained. It was not long before a judicial decision ordered the dissolution of the organization and the restoration of the previous outward signs of rivalry. Among the patent aggregations similarly broken up by court decree have been those employed in the manufacture of bath-tubs, motion picture apparatus, and coaster brakes.

Did the patent combination formed to control oil cracking, mentioned above (p. 454), conflict with the anti-trust laws? When the question was brought before the United States Supreme Court it was discovered that cracked gasoline constituted only a quarter of the total domestic supply of gasoline. All of the remaining three-fourths was provided through another process—that of fractional distillation. As the members of the oil-cracking pool did not own in common the patents for the competing method of fractional distillation, it was held that they could not manipulate prices unreasonably. Hence the judges ruled that the oil-cracking pool did not unduly restrain trade and was therefore legitimate.

#### INCREASED SOCIAL CONTROL OVER INVENTION

**Patent System a Key to the Control of Industry.** As pointed out, the existing patent system is complex and makes for all kinds of delays and conflicts; it allows the holders of patents to enjoy monopolies, to prevent the use of devices, and to fix unreasonable prices. It can go little further along present lines. Yet the constitutional provision which encourages invention, by allowing monopolies for the manufacture of new devices, could be employed to stabilize and promote greater efficiency in the industrial life of the United States. By controlling the basic instruments of technology through patent administration, statesmen of broad vision might be able to rationalize large areas of economic society

on a generous scale. Despite the fact that jurisdiction over patents constitutes potentially one of the mightiest arms of government to be used in the public interest, its possibilities have been but slightly explored. Here is a fertile field for inquiry and thought.

### **Efficient Use of Inventions from a Technical Viewpoint.**

Assuming that the patent system is to be revised with a view to encouraging rationalization in industry, what should be its objective? A ready answer is that the goal should be to promote the "efficient use" of inventions. To the engineer "efficient use" means a definite thing. If a new machine appears that is capable of performing a given task with a lower expenditure of time, energy, and materials than an older contrivance, he is moved to adopt it on purely technical grounds. Many instances of the sort are on record—the replacement of hand sewing, cotton ginning, and weaving, by machinery, for example. If he is loyal to the rationality of his science, the engineer is compelled to say that the patent system should promote the discovery, immediate adoption, economical application, and widespread use of superior devices.

**Efficient Use from the Business Standpoint.** On the other hand, the primary concern of the businessman in the possession of an invention or a discovery is the possibility of profit, which may involve the limited use or complete suppression of the device. Suppose, for example, that a concern owns a plant for the production of goods in large quantities. Then imagine that a method is patented for increasing materially the durability of the articles turned out. In this case the company may find it more profitable to buy up the patent and never use it, than to attempt to sell a commodity of such lasting quality as seriously to reduce the replacement sales. Until the patent runs out, nobody can interfere with the process, for there is no existing Federal rule requiring patents actually to be put in service. Similarly, if a plant is equipped with machinery for performing a given operation, and more advanced apparatus, covered by patents, is about to appear,

it may be cheaper for the owners to buy up the new rights and hold them in abeyance than to scrap existing facilities. Competitors are thereby prevented from rendering the old factory obsolete by themselves installing better facilities in another plant. Inventions can be, and often are, in fact, suppressed for commercial reasons during all or part of the life of the covering patents. From the standpoint of ordinary business, the patent system should be made a servant of the profit motive.

**Efficient Use from a Public Standpoint.** The public's conception of "efficient use" represents still a third point of view, one quite distinct from that of either the technician or the businessman. For example, an invention appears that performs an automatic operation. Technicians favor its immediate adoption, and businessmen put it into service because it offers greatly increased profits. Yet hundreds of men may be thrown out of work by it, and forced on private charity or the taxpayers. The public may indeed obtain a cheaper product, but an army of consumers may lose their wages at the same time. The economic gain may be more than offset by the social loss. In fact a great deal of the responsibility for the depression that opened in 1929 is justly placed on the introduction of labor-saving devices. Even if we accept the classical theory that in the long run dislocations brought about by inventions are duly adjusted, the social distress which accompanies the process becomes a matter of grave public concern. Conversely, since a patent is a monopoly, it frequently happens that advantage is taken of the freedom from competition to raise to inordinate levels the prices which the public must pay. This is perfectly legal, and, indeed, profitable business tactics. But insofar as it delays and restricts the employment of an urgently needed device it may not be conducive to efficient public use.

**Proper Objectives for a Patent System.** Since patents are government grants, and the Government is "a servant of the public," it would appear that the popular conception of



what constitutes "efficient use" should be controlling. If the suppression of a patent, for private profit, works harm to consumers, they may legitimately call for the immediate exploitation of the device. On the other hand where labor-saving machinery is being introduced with too much speed, and people are being thrown out of work faster than they can be reabsorbed by industry, citizens may properly request a slower, regulated pace—a pace which does not endanger the safety of society by violent disturbances in economy. As for the promotion of technical progress, certainty of reasonable reward for the inventor (who often gets little or nothing anyway) should be held out in place of the gambler's chance which he now enjoys in innumerable cases.

**Potentialities of the Patent System.** Although the goals may thus be set in general terms, ways and means of achieving them are not easily determined. The clause of the Constitution which vests in Congress the power to grant exclusive rights to inventors for limited times is broad and general, and presumably Congress could, through the exercise of this power, exert a wide control over the exploitation of patents with respect to the various interests concerned. It has the positive power to fix the *times* for which exclusive rights may be enjoyed. Thus, the time might be made long or short, or might be extended, in accordance with the methods of exploitation employed by the holder of the privilege. The life of the ordinary patent might be made five or ten years. If, then, a patent were granted for a device which would double or treble the life of a commodity, without adding materially to its cost, and if the holder refused to put it to immediate use, the minimum term might be applied to it. If on the other hand proof were afforded that the patent is being exploited in a satisfactory manner, the holder might be granted one or more conditional renewals.

The public policy to be enforced, however, would depend upon the theory of political economy adopted. If the *laissez faire* doctrines of classical economy were accepted, the course

might be fairly simple. Congress might operate on the assumption that its duty is to force every patent into rapid use, without respect to old processes and methods or the vested rights of other inventors and manufacturers. It would undertake no responsibilities in the matter of unemployment and would require every patent holder to begin exploitation and marketing at the earliest practicable moment. In this way, presumably, the public would have the immediate benefit of reduced prices or better commodities. Congress might even provide that only in case a new patent were offered to all manufacturers on a royalty basis, would the usual term of five or ten years be extended. At all events by virtue of its control over the time element, Congress could force almost any policy of exploitation on the holders of patents.

On the other hand, if the theory be accepted that it is the duty of the Government to intervene in behalf of menaced manufacturers, consumers, and employees, Congress could use the time element to slow down and direct the exploitation of patents with reference to the general interests of the public. Here all the problems of planning and controlling production, through the coöperation of government and business enterprise, enter into consideration. Here the rules for establishing patent policy are to be sought in the ends and methods of national control over industry, during depressions and during seasons of prosperity, with a view to stabilizing production and distribution and retarding the violent oscillations in economy. Although neither the *laissez faire* rule nor the rule of planning is now applied, it is evident that patent policy should not be determined in itself but as a phase of planning and control in general (see below, Chapter XVIII).

Precedents may be found for such policies. Certain foreign governments require holders of patents to put the same to use or they automatically lose their rights in a short time. Furthermore the United States Congress has, by special act, occasionally extended the life of patents beyond the normal

period of seventeen years. Hence there seems to be nothing radically novel about the principal of adjusting expiration dates to social ends. The success of the control would depend, of course, upon the ability of the body charged with fixing patent durations to operate honestly in the public interest. Preferably the task should be placed in the hands of a Federal executive authority, held within certain limits set by act of Congress, and coöperating with agencies of planning and control established under Federal auspices.

### COPYRIGHTS AND TRADE-MARKS

**Copyrights.** Among the items subject to copyright are technical books, professional magazines, addresses before engineering societies, maps, drawings, plastic models of a scientific character, photographs, and motion pictures. To secure a copyright an applicant must first give due notice to the public and to the Government. This is achieved by printing on every issue of an article offered for sale a statement to the effect that the same is copyrighted, and by sending proper samples of the composition to the Copyright Office, Library of Congress, Washington, D. C. Finally, after a small fee has been paid, the Library will prepare the necessary registration papers. A copyright vests in its holder the "contestable" power to prevent others from pirating his works for an initial period of twenty-eight years. One renewal, for a further twenty-eight years, is permitted to the original holder or his heirs and assigns.

The term "contestable" power was used advisedly, for copyrights do not constitute clear-cut monopolies. On the contrary the Library of Congress is confronted with so much closely related material that it does not even go through the formality of attempting to pass on the originality of any work. Copyrights are indiscriminately issued to all comers. It is perfectly possible, then, for several copyrights to conflict openly. Where important questions are involved, the dispute may be thrown into the courts, and here the dates of



registration serve to establish priority. Not until the judicial mind has given its stamp of approval to a copyright does it change from a "contestable" to an "absolute" monopoly.

**Trade-Marks.** Commercial products generally bear a trade-mark of some kind. Westinghouse machinery is stamped with a large W in a circle. General Electric devices carry the letters GE in script. Distinguishing designs or names on goods entering interstate commerce may be registered with the Patent Office, at Washington, D. C.; those employed solely in trade within a state may be registered within the appropriate state trade-mark office. Usually the registration procedure is simple. The words and emblems are sent to the proper authorities who examine their files for evidences of priority. Certain marks, as for instance one portraying the head of an individual now living but without his permission, are not acceptable. Where there are no objections to the application, the necessary papers are issued upon payment of a small fee. Holders of a registered trade-mark are given indefinite "contestable" protection against infringements by others. Here again, as in the case of patents and copyrights, "absolute" protection may not be forthcoming until after the validity of the device is tested through litigation. Despite its faults, the service is essential, if the buyer of an article is to be safeguarded against spurious commodities, bearing famous names, but in reality turned out by irresponsible competitors.

## CHAPTER XV

### HEALTH AND SAFETY REGULATIONS

Technology, since it is concerned with the construction, operation, and regulation of water systems and the disposal of wastes, comes into direct contact with problems of health and sanitation and thus with bacteriology and medicine. This was early recognized by engineering science and considerable attention given to the issues and contingencies involved. Later, as medical science made progress, other impacts of technological enterprise on the health of employees and the public were discovered; and ultimately the dangers of machinery and chemicals to life, limb, and well-being were brought within the purview of technology. In many respects, engineering has been tardy in extending its area of inquiry, but in recent years it has been steadily widening its domain of thought to cover health and safety. It has been influenced by developments in the neighboring divisions of biology, botany, and medicine. Indeed, in its broadest connotations, technology includes these sciences, for though engaged essentially in physical undertakings, it works in a biological world composed of living beings, ranging from amoeba to man, and must take their nature into account. And as technology and science have extended their knowledge of new hazards, governments have followed by adding new functions of control and regulation. Although all of these functions cannot be described in such a limited volume as this, their principal aspects must be noted.

#### HEALTH REGULATIONS

**Old Methods and New.** Few experiences are more disheartening to human beings than that of seeing neighbors

die from disease, without having any power to help them, and perhaps expecting to suffer a like fate. In 1793 Philadelphia went through such an experience when yellow fever invaded the city. It was variously attributed to the Gulf Stream, decaying coffee on local piers, dry particles of dust, and the eating of apples. Preventives ranged from smoking tobacco, chewing garlic, and carrying pieces of tarred rope to shooting cannon and lighting bonfires to cleanse the atmosphere of pollution. Unhappily none of these schemes was successful. Seeing no alternative safeguard, the more cowardly left friends to perish of thirst, hunger, and sickness rather than go near them. Those who dropped dead on the streets sometimes remained unburied for days. A tenth of the inhabitants of the city had been visited by the grim reaper before the epidemic disappeared—as suddenly as it had come.

Bewildered for centuries by calamities of unknown origin, mankind had almost accepted them as inevitable, when a great boon came. Scientists at last began to solve riddles. The veil of mystery that had shrouded diseases from the earliest times was gradually lifted by patient effort until today we know the causes of and the best methods of treating most of the deadly epidemics at least. It has been found, for example, that yellow fever is carried by mosquitoes of a type peculiarly susceptible to destruction. All that remains to banish such plagues is to put new knowledge into intelligent use. Seizing this great opportunity to help the public, governments have undertaken to stamp out pestilence through the establishment of official health regulations, institutions, and practices.

**Compulsory Vaccination.** American governments have experimented with the prevention of smallpox and certain other diseases through the agency of vaccination. It is an established fact that if the human system is attacked with a mild form of these disorders, it will not only recover quickly but will in the process build up so much resistance to the



injurious germs involved as to protect the body against fatal attacks at a later date. To produce wholesale immunity among the inhabitants of any region, however, requires something more sure than mere voluntary vaccination—the strong arm of the law must intervene to force those who do not relish the operation nevertheless to submit to it. Consequently in several states all children are required by the government to be vaccinated for smallpox before they attend public school. The results of the compulsory system have been most gratifying, as the comparative figures for Massachusetts and Minnesota demonstrate. During the years 1920 to 1923 inclusive, Massachusetts, with compulsory vaccination, had only 74 cases of smallpox, whereas Minnesota, with a smaller number of inhabitants and no compulsory vaccination, had over 19,000 cases.

An important feature of government regulation, in connection with vaccination, is the control exercised by national authorities over serums, viruses, and anti-toxins. If the substances used in conferring immunity are of improper strength or are polluted, they may do far more harm than good when applied to human beings. Recognizing this fact, every concern producing such material for the interstate market is required to secure a Federal permit before engaging in the business. Duly licensed plants are periodically inspected and their output checked from time to time by the Federal Public Health Service.

**Quarantines.** Where immunity has not or cannot be conferred, the problem of preventing the spread of infections, through personal contacts, becomes a major one. The growth of industry has concentrated people in cities where factories, rapid transit facilities, office buildings, stores, theaters, and schools afford ideal media for the local dissemination of germs. Nor can diseases be held down to small areas, for the long-distance agencies of modern transportation—steamers, trains, airplanes, and motor cars—are quite capable of distributing them to all quarters of the globe.

These conditions have been met, in part, through the development of a special quarantine technique. To protect citizens, the Federal Public Health Service prevents the entry into the United States of all persons suffering from specified diseases. The separation of the healthy from the unhealthy, and the disbarment of the latter, is accomplished in two stages. Federal agents are now stationed in many European cities for the purpose of inspecting prospective immigrants, and aliens found to be unfit are refused passport visas, without which it is useless for them to try to enter the country. As a second check, persons reaching American soil, whether previously examined or not, are examined to see whether the state of their health entitles them to remain in the United States. Those found to be ill are either treated in hospitals at the port where they disembarked or are returned to their native land. The above process for barring infected individuals from the country is substantially aided by an international service whereby outbreaks of disease at foreign points are reported by cable and radio to Federal officials. Immigrants coming from centers where plagues are said to be raging are presumed to be menacing and are subjected to especially rigid examination.

An interesting example of the effects of technology on government is the influence of speed on the efficiency of foreign quarantine services. Suppose, for instance, that the incubation period of a disease is two weeks. In the days of the old-fashioned sailing vessel, voyagers infected with the disease just before embarking in Europe would come down with it long before the craft could possibly reach the United States. But now, when fast liners make the voyage in six days, an infected individual can leave Europe and arrive at his destination in America a week before symptoms appear. For this reason, the condition of trans-Atlantic passengers can no longer be perfectly determined by merely looking at them as they walk past Federal officers, nor by an examination of the records of the ship's doctor.

Persons already living within the United States are also subjected to government quarantine regulations. Most states and cities now require physicians to report to the proper health officers whenever a case of contagious disease comes to their attention. Once the existence of dangerous conditions is thus brought to the notice of the authorities, they may proceed to isolate the residence of the patient. Placards are posted on doors forbidding the entry of ordinary callers, and inspections are made from time to time to determine whether orders are being duly respected. Where it is feared that the restrictions cannot be enforced at home, the victim may be ordered removed to a special hospital or "pest house" so that his actions can be carefully watched. Nor is there any relaxation while the sick are traveling, for they must comply with rules safeguarding fellow passengers. If scores of individuals are involved together in a plague covering a considerable area, wholesale measures must be taken. Emergency government control, in such circumstances, may closely resemble martial law throughout the distressed district.

**General Sanitary Regulations.** Disease may be spread by physical surroundings as well as through contacts between persons. Consequently governments have been driven to undertake the supervision of general sanitation as a fundamental part of their war on contagion. Vessels touching American ports are fumigated by Federal agents, to kill rodents—potential carriers of the dreaded Bubonic plague. Railroad coaches must be washed and dusted at specified intervals. City health authorities frequently possess the power to order the rat-proofing of houses. Barber shops must comply with compulsory standards of cleanliness relative to the use of towels, brushes, and combs. Factories, markets, dairies, and restaurants are permitted to handle food only after obtaining formal licenses. Filthy kitchens, inadequate lavatory facilities, and other bad conditions are noted during the regular rounds of official inspectors. Owners



of establishments found to be in an unsanitary plight may then be punished either through revocation of their permits or by fine and imprisonment. Naturally the task of watching thousands of individual places of business is an enormous one. It cannot be discharged with perfection, but the technique of supervision is being improved.

**Occupational Diseases.** Mere freedom from dangerous germs is not enough to insure well-being, for exposure to injurious chemicals in the course of modern technological operations may give rise to occupational diseases, in which bacteria play no part. Thus in the manufacture of nitro-cellulose, nitrous fumes may attack the air passages of workmen, causing rapid corrosion of membranes. When tetraethyl lead for automobile fuel first came on the market, a number of laborers in the producing plants suffered from lead poisoning. Stainless steel and chrome nickel trades require quantities of chromic acid. Operatives engaged in its preparation may develop chrome ulcers in their noses which ultimately eat through the tissues. Lead poisoning is a source of fear to painters, smelters of lead ore, sprayers of lead enamel, and makers of storage batteries. A number of men in the felt-hat business have been harmed by the mercury compounds used for treating furs; copper colored patches appear on the throat, the gums swell, abscesses form, and stomach trouble follows. Granite cutters inhale rock dust which renders them especially susceptible to tuberculosis. Plants turning out methyl chloride as a refrigerant occasionally report that the fumes cause intoxication, staggering, loss of weight, sleepiness, and trembling. Radium, in luminous paint, resulted in serious damage to the bony structure of some women applying it to watch faces or hands. Jaws have been eaten away by the fumes from chemicals used in making old-fashioned poisonous phosphorus matches. It is not contended that these evils are universal, but engineers owe it to the public to see that they are mitigated.

On the whole, governments have given comparatively

little attention to occupational diseases. Mention has already been made of one official effort, however, that by which Federal authorities destroyed the poisonous match industry through the imposition of prohibitively heavy taxes (p. 293). States, too, have taken some action. For example, Illinois requires the owners of certain plants, in which noxious or poisonous dusts are prevalent, to furnish their employees with approved respirators. Not only must these devices be supplied to operatives free of charge, and maintained in good condition at all times, but the employees are under legal obligation to wear them.

**Smoke and Noise.** Other evils are excessive smoke and noise. Smoke not only renders a city filthy, but it deposits soot in human lungs. In an effort to abate this nuisance, several municipalities have adopted ordinances penalizing companies for discharging unreasonable quantities of smoke into the air. Rochester, New York, enforces the local code through a city official, stationed in a high tower from which he scans the horizon with the aid of a telescope. Once an offending stack is spotted, its owners are warned to improve the firing of their boilers immediately. Noise, held responsible for injuries to human nerves, is a more difficult problem to deal with politically. At present governmental activities in this direction are confined to such details as the suppression of needless clatter in the vicinity of hospitals and schools, or the stopping of loud noises at night.

**Pure Food and Drug Laws.** Man is what he eats. Consequently healthful physical surroundings are of little avail unless individuals have proper food. Formerly the housewife procured substantially all her meat, fish, fruit, and vegetables in their natural state. Today, when she buys foods that have been processed in a variety of ways, there is no such guarantee of quality. On the contrary foods are artificially ripened, bleached, recolored, or preserved with antiseptics, hiding their true character and sometimes introducing harmful chemicals into the human system. Grains are

treated to break them up into their components—such as bran, starch, and flour—filling the market with articles containing but a fragment of the nutritive elements present in the original kernels. Cheap substances are employed to adulterate products to increase profits, as in the case of the substitution of chicory for coffee. Since these operations are carried out at distant plants, which the housewife knows little or nothing about, and since she is not equipped for chemical analysis, she is a prey for unscrupulous manufacturers, of whom there are always a certain number. Only after widely publicized revelations of malpractices, did a great and successful drive begin for government regulation. As a result of this bitter battle, Federal, state, and municipal control and inspection of foods have been generally established throughout the country.

In general, Federal and state pure food laws require that foods be prepared in a sanitary manner from wholesome ingredients. Diseased and spoiled meats are thus banned. So, too, the addition of harmful preservatives, coloring matter, and cheap adulterants is forbidden. Finally articles must be honestly labeled, regardless of their nature. Purchasers are thereby assured that the contents are not grossly misrepresented in the majority of cases. Inevitably highly technical chemical questions arise in this connection, forming fertile grounds for dispute between private parties and government authorities. These conflicts have been partly resolved through the development of a series of standards giving in detail the proper legal composition for hundreds of common necessities, and for colors and preservatives. Such specifications serve as a rigid guide which the food industry is expected to follow. Corresponding rules are applied to many drugs, but not to dangerous cosmetics, although there is a strong drive in that direction.

Enforcement begins with the collection by government inspectors of samples of commercial products in market places or in factories. These samples are sent to official sta-



tions where they are tested to determine whether they comply with the law. If they fail to do so, the parties responsible for the violation are given warning. Where this course is unavailing, offenders may be prosecuted in court, and their products seized and destroyed by government agents, without compensation. The importance of such activities is illustrated by the following examples of articles removed from trade channels by Federal agents: chicory and clay molded in the form of coffee berries, colored and flavored to represent coffee but containing no trace of the latter; white stone ground into a fine powder and mixed with wheat flour; vinegar tintured with sulphuric acid; milk made synthetically and not containing one drop of the genuine substance; artificially colored sawdust ground and added to cayenne pepper.

**Drug Addiction.** Habitual consumption of opium, cocaine, and morphine constitutes a menace to health. While no accurate figures are available as to the extent of the drug habit in the United States, the number of addicts is variously estimated at between 100,000 and 1,000,000 persons. Seeking to hold this total to a minimum, Federal, state, and local officials are constantly engaged in enforcing laws forbidding the sale of narcotics, for other than medical purposes.

**Regulation of Medical Treatment.** Despite the best efforts of governments to prevent disease, thousands of individuals fall ill every year. In their search for relief, these unfortunates are bewildered by a vast assortment of "scientific" wonders, of which "magnetic belts" are typical. Hundreds of such articles are pure frauds. Worthless treatments do more than rob the gullible of their money. When a nostrum does not actually aggravate a case, it may give a patient a false sense of security, inducing him to avoid proper care until dangerous, if not fatal, complications have developed. To protect the public from unscrupulous concerns, Federal and state laws now forbid the sale of misbranded and therefore fake cures for diseases. Many extraordinary

"medicines" have been removed from the market by government agents, of which the following array is typical: a cure for pernicious anæmia consisting largely of ground granite; a cure for cancer in the form of a bread and milk poultice; two syrups similar to New Orleans molasses offered as a sure remedy for all ailments of the kidneys; and an epsom salts compound guaranteed to cure diabetes.

Sick persons coming under the direct care of local doctors are further safeguarded against deception. Generally speaking a doctor is forbidden by law to treat patients until he has demonstrated his ability to the satisfaction of a state board of examiners and obtained a formal license. Unfortunately the effectiveness of this system is weakened by quarrels between rival schools of medicine. Opposed to the conventional practitioners are the osteopaths and chiropractors who trace diseases to complications of the nervous system or spinal column. Sometimes the latter maintain that a manipulation of these centers is sufficient to remedy all difficulties, regarding surgery and other commoner procedures as quite superfluous. Christian Scientists believe that there is no such thing as real sickness, and that a change in mental attitude is an infallible remedy. Obviously these groups are mutually exclusive, and cannot all be simultaneously correct. Since each wields power in the government, however, licenses are issued where none should be, and exceptions are made where none should be allowed. As a result, extremists continue to carry out their ideas to the detriment of the public at large. What is more, no simple reform appears possible until human nature changes.

**Results of Public Health Work.** Government public health work, coupled with private medicine, has accomplished wonders. In the last thirty years the stamping out of disease has progressed apace. In 1900 the number of deaths per 100,000 individuals in America from typhoid and paratyphoid was thirty-six whereas in 1929 it was only four; tuberculosis fatalities fell from two hundred and two, to seventy-

six in the same interval; while diphtheria casualties dropped from forty-three to seven. Summarily, the death rate from all causes, per thousand persons, fell from twenty a year to twelve between 1900 and 1929. The average life of man is now some fifty-six years, a sixteen-year gain over the previous century!

### SAFETY REGULATIONS

**The Menace of Accidents.** There is subtle irony in the fact that doctors have learned how to conquer disease just in time to see their hopes of increased human longevity countered by the advent of destructive technological devices. Month after month men and women file out of hospitals, where they have been cured of ailments by the latest scientific methods, only to be struck down a little later by machinery gone wild. Out of the wreckage of modern contrivances are dragged thousands of bodies every year—fresh sacrifices on the altar of engineering progress. Automobiles, in the United States alone, killed 34,000 and injured 990,000 more during 1931. Death rains down from the skies above; in 1930 over 300 were killed in 2,000 aeronautical accidents. In extracting coal from the depths of the earth, 2,000 men were killed and 100,000 hurt in 1930. Headlines carry news of great individual calamities. At Nixon, New Jersey, a nitration plant explodes, killing twenty and maiming sixty. In California, 450 are carried to their doom as the St. Francis Dam fails. Governments, working hard to reduce the death rate through public health services, view with deep concern the growing inroads of accidents and seek to check the menace by minute regulations, controlling the use of dangerous machinery and chemical processes.

**Building Codes.** One of the more common contacts of the engineer with government safety requirements is in connection with construction work. Many municipalities have adopted building codes designed, among other things, to assure a reasonable degree of strength in private structures.



To this end they specify in detail the maximum allowable working stresses for steel, brick, concrete, and stone; the manner in which the various component members shall be fabricated; and the allowances to be made for wind, snow, or earthquake loads. The importance of such provisions was emphatically emphasized during the California earthquakes of 1933. When the worst of the tremors had subsided, a number of dwellings, as well as schools, were in ruins. Overhanging cornices and decorations fell off by the score, crashing into the streets to the peril of pedestrians. Bricks were not adequately bonded to steel frames. Ample account had not been taken of possible transverse movements of the earth in planning foundations. As an aftermath of this catastrophe, a revision of local regulations was made to prevent a repetition of such mistakes.

Building codes are not limited to matters of structural strength; they cover fire hazards as well. An excellent reason exists for this extension of scope. Despite the fact that cities have poured millions of dollars into the latest fire-fighting equipment (p. 404), they have been unable to score good records by the application of curative measures alone. One by one they have been forced to embark on extensive supplementary programs of prevention. A common step is to divide the municipality into fire zones, specifying in detail the type of construction to be permitted in each; Pasadena, California, has four such zones. Wooden frames are tolerated in residential sections for there the houses are small and separated by yards. More resistive design is required in business districts where the buildings are larger and packed more closely together. Unusually hazardous industries—dry cleaning plants employing inflammable and explosive fluids, gas works, dynamite storage facilities, and wood-working shops—are restricted to special areas. Besides the broad classificatory regulations, there are others relating to such dangers as electric wiring, chimneys, gas ranges, and motion picture films. Preventive control of this nature



*Photograph by Acme Newspictures, Inc.*

#### A FACTOR IN BUILDING CODE REFORM

One of the buildings damaged by the California earthquakes of 1933. Such failures were responsible for the revision of local building codes (see opposite page).



*Photograph by Acme Newspictures, Inc.*

#### WHAT CAN HAPPEN IF SAFETY RULES ARE NOT ENFORCED

The fire aboard the S.S. *General Slocum*, in 1904. Several hundred women and children perished in the disaster because Federal inspectors had failed to order the replacement of rotten life-preservers and defective fire hose, and the removal of wire lashing from lifeboats, even though required by law.



has proved of substantial help in reducing fire losses throughout the country.

Building codes are enforced through a detailed inspection system. The process begins when architects submit drawings and computations for proposed structures to city officers. After checking the plans, the latter issue permits, authorizing work to proceed. Inspectors are sent to the scene of operations, during erection, to make certain that the original designs are being faithfully followed. Finally, when the task is done, a certificate is prepared, empowering the holder to open up the quarters for occupancy. From time to time surveys are made for the purpose of estimating the amount of deterioration. Where serious weaknesses have developed, condemnation orders ensue, preventing further use until suitable repairs have been completed.

**Safety Rules for Factories.** Governmental control over the strength and fire resistivity of buildings is supplemented by laws regulating the operation of such dangerous machinery as they contain. With the advent of modern machine-tools, running at high speeds and designed to rip through the toughest of materials, workers have been subjected to extraordinary perils. The failure of private parties to furnish suitable protection for their employees induced the government to develop and apply safety regulations. Illinois standards are typical. In that state, woodworking mechanisms must be equipped with guards so that swiftly moving saw-teeth cannot readily touch the operatives. Revolving shafts and belting, which might catch hair or clothing and whirl victims to their doom, must be partially covered. Every plant must have a central device for stopping all apparatus on a moment's notice, so that workers suddenly trapped in moving machinery, will not be ground to bits while their fellows stand by helpless to halt the process in time. Enforcement of such precautions is left to inspectors who make periodic rounds of industrial establishments, demanding changes as required. Penalties are imposed on

concerns repeatedly failing to comply with government safety requirements.

**Safety at Sea.** A variety of measures has been enacted by governments for the reduction of transportation hazards. The earliest of these related to water travel. As developed to date, national rules forbid the operation of powered vessels, above the size of a small motorboat, on the high seas, the Great Lakes, or large rivers unless they have secured a license for the purpose. Prior to the issue of a license, the vessel is inspected in detail to make certain that it is well built, complying with voluminous official specifications covering such items as boilers, hand steering rigs, and water-tight bulkheads. To insure the presence of the proper apparatus for coping with emergencies, the Government orders the installation of radio equipment, suitable for sending out SOS calls, on many vessels engaged in carrying passengers. The number of lives saved by the timely arrival of craft summoned by wireless to the aid of ships in distress bears eloquent testimony to the supreme value of this provision. Steamship owners are compelled by the authorities to equip their vessels with suitable fire-fighting instruments. Finally the law demands that ships carry enough lifeboats, life-rafts, and life-preservers to sustain afloat all on board, in case it is necessary to abandon a craft.

The human element is of supreme concern. When disaster impends at sea, and life and death hang in the balance, it is often the individuals in command, far more than mere equipment, that determine the final outcome. Recognizing this fact, the national Government has adopted a system of tests to insure a reasonable degree of ability among the officers and men managing American vessels. The captain, the mates, the chief engineer, and his assistants must all hold Federal licenses, secured on two conditions. First of all, the applicant must prove that he has completed a satisfactory marine apprenticeship covering a period of years, and secondly he must pass a written examination on theory and

practice. It has also become a policy to require a certain percentage of the sailors to qualify as "certified lifeboat men," by proving their skill in the handling of life-saving apparatus. Taken as a whole, Federal marine rules have materially reduced the hazards of travel by water.

**Reducing Railroad Accidents.** Turning our attention to land travel, we find the railroads of the country subjected to elaborate national safety regulations. A few concrete illustrations may serve to show the desirability of such control. For example, past experience proved that the use of hand brakes on long freight trains was very dangerous. After the signal for applying the brakes was given by the engineer, brakemen ran along the tops of box cars, on narrow walks having no guards, climbed down ladders to flat cars, crossed them, went up more ladders, over more box cars, and so on until they had reached the brakes on enough individual cars to stop the train. In stormy, snowy weather, with rough road-beds, it frequently happened that a hurrying brakeman lost his foothold, dropped off the roof of a car and plunged to his death. Even when a trip was made without mishap to brakemen the whole massive mechanism might roll on to its doom before the braking operation could be completed. To do away with such evils, Federal rules now specify that all interstate trains shall be fitted with airbrakes. Again, the old process of coupling cars by hand, whereby workmen stood between cars while they were being backed together, crushed many a limb and destroyed many a life. Hazards from this source have been responsible for the issuance of orders compelling railroads to use automatic couplers. To cite a third and last case, hot ashes were once emptied from locomotive fire-boxes by men working underneath the engines. This practice has been eliminated by recent legislation requiring locomotives to be designed in such a manner that firemen need not go underneath to remove ashes. Federal mandates, of which the above are typical, have resulted in a marked decline in railroad accidents.



**Safety on the Highways.** Most destructive of all forms of land transportation is the motor vehicle, an agency responsible for the death of more than 30,000 people a year. In attacking the major accident problem created by the automobile, state laws set up mandatory safety standards for equipment. Since the average reader is more or less familiar with these standards through his own personal driving experience, there is no need to go into much detail here. Suffice it to say that blinding glare from headlights is minimized by stringent orders specifying the legal candlepower for bulbs and certain optical properties for lenses. The presence of two sets of brakes, insuring a full stop within a fixed distance, even if one system should fail, is also a generally prescribed safeguard; while a horn or other signaling device forms a third essential piece of mandatory apparatus.

Several methods are employed in the enforcement of these equipment regulations. In certain states, officers set up "traps" on important roads, unexpectedly halting and testing passing vehicles. Occasionally, the campaign assumes major proportions and cars go to certified testing stations by the hundreds. There they are checked and stickers are placed on the windshields of those found to be in satisfactory condition. Owing to the large number of mobile units operating on the highways, however, government control over auto maintenance is usually far from rigid.

Even if an automobile is in mechanically perfect condition, it is still a dangerous machine unless handled with care. As a means of fostering safe and sane manipulation, states and cities have adopted traffic regulations which are enforced by mobile police units. These rules serve a double purpose. They prohibit reckless practices, such as driving at excessively high speeds or overtaking cars on blind curves. Secondly, they help to prevent confusion in all kinds of situations—at intersections, when an ambulance is approaching, and elsewhere—by prescribing the precise duties of each party involved. But the mere placing of commands on the

statute books is of slight value unless drivers are themselves competent to apply them. In recognition of this fact, many states require individuals who wish to drive to pass suitable oral, road, and physical examinations and obtain a license for the purpose. Thus men and women with defective vision, nervous temperament, slow reaction time, and poor co-ordination, those ignorant of the rules of the road, or otherwise disqualified, are supposed to be debarred from the highways. So unmistakably appropriate is this safeguard that it is surprising to find half the states, as late as 1931, making no provision for the issuance of driver's licenses. Extension of the testing system into such areas would certainly be a step in the direction of reducing the annual accident toll.

**Aëronautical Safety.** Turning from the earth beneath to the skies above, governments have attempted to deal with aëronautical hazards. It is now an almost universal requirement in the United States that aircraft be licensed when in active service. Owing to the great risks involved, airplane licenses are not issued in a perfunctory manner. As a prerequisite for licensing, the mechanisms are given rigid inspections, at periodic intervals, to determine whether or not they conform to highly detailed official standards of airworthiness. Potential fire hazards, general strength, stability in the air, instrument equipment, and engine installation are a few of the items subject to check.

But it is not enough to see that planes are in good condition; they must also be properly handled. As in the case of automobile travel, so in the air, traffic rules control operations. Typical of such regulations are the paragraphs setting minimum altitudes at which craft shall cross over cities or other areas, when not landing or taking off. Again we find that rules are of slight value unless applied by competent men. To insure a reasonable degree of skill among pilots, they are generally required to secure appropriate licenses. In all interstate traffic, they must hold Federal licenses.

Their physical condition, manipulative skill, and technical knowledge must be satisfactory to the examining authorities before a license will be issued. Especially strenuous efforts have been made by governments to cope with flying perils on account of the general lack of public confidence in the new industry.

**Settling Accident Claims by Damage Suits.** Despite official attempts to reduce the annual toll, between two and three million industrial accidents occur every year in the United States, with 25,000 or 30,000 fatalities. Originally the suffering of victims was partially alleviated through regular common-law channels. An injured person could recover damages through court action, provided he could prove that his mishap was due to negligence on the part of his employer or a managing agent. But the expedient was far from satisfactory in fact. A large number of casualties were due to the carelessness of the individual injured or of some fellow-worker, or to the inherent risks of the trade. Companies were not required to make compensation in such circumstances. Naturally the border-line cases in the law courts often went against the injured plaintiffs. Furthermore lawyers were among the prime beneficiaries of the whole arrangement, earning good fees as growth in the use of high-speed machinery and dangerous chemicals raised the volume of litigation to high proportions. For these and other reasons, proposals were put forward for some simpler method of award in accident cases.

**Workmen's Compensation Legislation.** Today forty-four states, the Federal Government, and several outlying possessions have established, within their jurisdictions, systems of simplified award, under official supervision. Owing to constitutional difficulties in some states, employers must sometimes be given the option of accepting these improved arrangements or continuing the historic plan of court trials. But even in the latter case the old evils are partially overcome by placing restrictions on litigation, with a view to



protecting the plaintiff. Whether compulsory or not, the new policies entitle operatives "injured" in the pursuit of their normal activities to receive direct financial compensation. At first "injuries" were defined so as to include only sudden and violent mangling of the body. Occupational diseases, slowly developing in the bodies of their victims, were excluded. Now through a liberalization of existing statutes, eleven states and three territories require payments to be made for occupational disorders. Sometimes the coverage merely names a few of the major types. Thus in Minnesota the following, among others, are indicated by law: cataract of the eyes of glass workers as a result of exposure to the glare of molten glass; sickness from compressed air; anthrax from handling wool, hair, bristles, hides, and skins; and lead, mercury, phosphorus, arsenic, carbon bisulphide, and nickel carbonyl poisoning. Blanket provisions encompassing all forms of trade maladies are applied in other jurisdictions.

Compensation under the various laws is roughly proportioned to the extent of the injuries involved. Payments may be made in lump sums. Thus in New Jersey a definite scale of progressive "dismemberment" is on the statute books. A dollars and cents value is placed on eyes, fingers, hands, arms, feet, and other portions of the body. An alternative is the weekly installment plan whereby a fixed percentage of the normal wage of the victim is paid to him during his convalescence. In this manner a steady income is assured him while recovering, preventing him from squandering his relief all at once. Where an individual is badly crippled, being no longer capable of earning a living, he may receive a pension; if he dies, his widow becomes a beneficiary. Allowances do not, however, cover the full cost of mishaps to the victim. On the contrary a substantial share of the burden is thrown on the laborer. Under modern legislation, persons entitled to assistance need only present petitions to the proper government commission, which usually renders a

decision on the case in short order. Occasional appeals may be taken to the courts, but on the whole red-tape is cut to a reasonable minimum. Employers commonly take out insurance for their forces rather than carry the risks themselves. Private companies may underwrite workmen's insurance, or the state may set up a government fund for the purpose, collecting annual premiums from industrial establishments.

Legislation of this type does more than compensate injured men; it acts as a preventive force as well. As long as the employer was able to escape liability for the general run of injuries, there was little direct incentive for installing safety devices. But now that mishaps are usually covered by policies issued through commercial casualty companies, premiums become an important item in overhead expenses. The more hazardous the conditions in a plant, the heavier the annual assessments. Consequently, it may actually prove cheaper in the end to improve operating methods than to carry penalizing insurance rates.

#### KNOWLEDGE AND PRACTICE

##### **Additional Problems of Health and Safety Control.**

Although the above pages rest on a digest of many volumes dealing with health, sanitation, and safety, they inadequately describe even the chief functions coming under this head. If they point out the range and nature of health and safety provisions, they still fail to indicate innumerable problems of legislation and enforcement that accompany efforts to establish public standards. Moreover, they leave untouched large areas of pertinent thought and practice connected with the possible extension of health and safety measures; that is to say, they deal with things as they are rather than with the potential achievements of technology and sanitation. It would not be proper, therefore, to leave the subject without touching upon these neglected aspects.

**Conflicts over Health Regulations.** Since, in connection with health activities, scientists are dealing with human

elements, differences of opinion arise among them over the nature and degree of injuries to health which lurk in many commodities and industrial practices. In other words, doctors often disagree here. Furthermore, where there is a satisfactory unanimity among chemists respecting the injurious properties of substances put on the market, their recommendations may be defeated by powerful private interests. Goods manufactured for sale on the open market are made, in the main, by private companies which naturally seek the largest possible profit from their undertakings. Among these concerns there is a great deal of competition, in which adulteration, misbranding, and other practices, such as misleading advertising, are employed to undercut and defeat rivals and deceive the public. Attempts to establish health standards are accompanied, therefore, by conflicts among specialists, and by heavy opposition on the part of private interests. As a result, legislation is often long delayed and many standards agreed upon by competent specialists are defeated in legislatures or in the process of enforcement. Those even slightly acquainted with the history of food and drug control are aware of the weighty, complicated, and constant battles that are fought in this field of governmental control. It would take an entire volume to cover them in a fairly satisfactory manner.

**Unused Potentials.** It is also well known to specialists in technology and medicine that the knowledge and facilities of these sciences are used only to a limited extent, partly on account of legislative and administrative conflicts and partly owing to the inability of persons receiving low salaries or wages to take advantage of them. For example, thousands of competent doctors, dentists, and specialists in sanitation and safety are only partly employed or entirely unemployed. For this reason the health and safety resources of the country are not as fully applied in practice as modern knowledge permits. Recognition of this fact has led in recent years to the development of a new conception of health,



known as social medicine. It finds partial expression in the increasing employment of public health officers and public or district nurses. As projected into the future, it contemplates the employment of doctors and nurses by communities or social groups, either through government directly, or under government authorization. It would apply, within many areas at least, the principles of insurance and public service to medicine with a view to making available to all the people the latest knowledge of health and safety practices. If we can now judge by the size of the literature on the subject and the number of conferences held on various proposals, it seems likely that the idea of public planning and control so evident in other fields of technology will be applied more extensively in the future to health and safety, drawing technology into new relations with government and its inevitable politics.

## CHAPTER XVI

### PERSONAL LIBERTY

On first thought it may seem strange that technology, essentially a physical science, should be concerned in any way with that elusive thing known to political science as personal liberty. Yet, as the following brief outline shows, there is a close relation between technology and personal liberty. It is clear that technological work is carried on by human beings, not by robots; and the right of human beings to do this or that, to pursue this or that calling, engage in this or that enterprise, or to think one way or another about their life and occupations is vitally related to the technological environment in which they live and carry on their constructive and operative activities. Thus, as we shall see, the right of persons to move from the soil on which they are born, the right to go to distant places and countries, and the right to choose and pursue callings are rights which have long been storm centers of discussion, with the progress of industry.

The right of a man to do things has always been related to the tools, instruments, and devices employed; and obviously technology, by creating new tools, machines, chemical substances, and devices, is bound to affect that right. For example, the control of public opinion now involves the propriety and feasibility of censoring vast news-printing plants, radio broadcast programs, and the movies; liquor-control controversies are complicated by the presence of drunken drivers on land and in the air; those who would have the strong arm of the law oversee home life are confused by the existence of scientific means for birth control with their great potentialities, good and evil, for the race. Today

the battle over personal liberty is fought against a background of science and technology. To the consideration of this struggle, where not covered in the discussion of democracy (pp. 63, 82 ff.) the present chapter is devoted.

### LIBERTY OF OPINION

**Liberty of Opinion in a Changing Social Order.** Democracies are based on mass action. Mass action follows in the wake of mass decisions, which in turn are best arrived at after free and open discussion of the important issues of the day. But those in authority, whatever their theoretical faith in democracy, are in practice fearful of allowing the public to express itself without restraint. Their grave distrust inevitably finds expression in the official muzzling of extremists among the opposition. In silencing individuals, however, they have little to guide them except their own inclinations, for few groups agree upon what ideas should be broadcast and what should not. If the task of suppression is unwisely done, the antidote may well prove more harmful than the original disease. Uninformed enforcement of censorship rules would be a very serious matter at the present time for technology is profoundly altering our whole industrial and social order. Extensive recovery experimentation is being carried on by the government amidst a wholly unique setting of science and machinery. Nobody, not even those in charge of the operation of these innovations, can really prophesy automatic success. Critical analyses of fundamental shifts of governmental policies are essential to the building up of a sound state. Liberty of opinion in these circumstances becomes of more than usual significance.

**Freedom of the Press.** At first the issue of freedom of opinion was dominated by the problem of free speech—the right of the individual to convey his ideas to others through the unaided voice. The Middle Ages altered this simple state of affairs by introducing the printing press and processes for the manufacture of cheap paper. Before very long, flaming



pamphlets were in circulation, stirring the popular fancy everywhere. Reading became increasingly common, with the result that at last public opinion could be greatly influenced through the eye as well as the ear. Perturbed by the steady flow of printed sheets, powerful church and state authorities tried to suppress what they considered to be dangerous writings. Printers were hanged, mutilated, flogged, branded, fined, put in stocks or thrown in dungeons, but their fellows were a hardy crew and they continued to set type undaunted by persecution. The struggle over the press, bursting out in full fury in England, naturally spread to her colonies in America, where censors punished overzealous printers. It was in the bitter school of experience that Americans learned to fear governmental supervision of writings. No wonder that the very first amendment to the Federal Constitution expressly forbids Congress to make laws abridging the freedom of the press, and that similar safeguards against local political interference have been placed in most state constitutions.

These constitutional safeguards are more than formalities. For example, Minnesota adopted a law in 1927 restricting the publication of malicious, defamatory, and scandalous periodicals. One newspaper, two years later, accused government officials of gross neglect of duty and illicit relations with gangsters. An official attempt was made to close up the publication but on appeal to the United States Supreme Court the state law was declared null and void, as imposing an unconstitutional restraint on the freedom of the press. Emboldened by such general security from punishment, American publishers have circulated an enormous amount of criticism of current politics among the public—so much in fact that the average citizen has acquired an inordinately low opinion of governments.

**Motion Picture Censorship.** The motion picture has won a position beside the press in importance as a molder of public opinion. Every day thousands of men, women, and

children file into the 20,000 movie theaters of the United States. Every week some fifty miles of new film are released, portraying such motley subjects as news events, racketeering, grafting politicians, or dramas of pioneering days. Due to its sheer volume alone, the steady celluloid stream is bound to make a strong impression on the American public. This impression is intensified by the fact that the human mind is peculiarly receptive to material presented on the screen and often remembers it better than the contents of a book read in the usual way. It is not surprising, therefore, that great mass movements of thought have their inception in the movies; and that sociologists are worried by the trend, calling upon official bodies for help in steering the movies into "safe" channels.

When pleading for governmental regulation of the movies, reformers have one important factor in their favor—the Federal and most state constitutions were prepared long before the motion picture was invented, and hence contain no guarantees of freedom for the movies comparable with those provided for the press. This absence of protection in our organic laws has permitted the growth of a fairly strong regulatory movement. To date, the Federal Government has taken a minor part in the demand for "good" pictures, confining itself mainly to the suppression of interstate traffic in prize-fight films which can hardly be said to affect deeply the trend of public opinion. But state and local authorities have made up for the lack of national rules by adopting motion picture censorship acts of their own. A survey made in 1929 indicated that there were then eight states and thirty municipalities with such control statutes. The Ohio law is representative. All motion picture films to be publicly exhibited in that state are subject to review, and only such films as are deemed by the Board of Censors to be of a "moral, educational or amusing and harmless character" are approved. The courts have generally upheld such legislation, giving the stamp of legality to close governmental regulation of the silver screen.

What are the practical results of the application of this legislation to everyday affairs? One effect is to exclude certain material from the screen that might arouse the political or social feelings of the audience in an undesired way. For example, a newsreel was banned in Pennsylvania because it showed relief work among striking miners, contrary to the ruling of the state board of censors that scenes of industrial conflict must not appear on the screen. Turning to New York State we find the board of censors reporting in 1924 that "an attempt is often made to disseminate propaganda through films, which is inimical to our form of government. The Department of Justice at Washington has been active in suppressing films of this character and has at all times had the hearty coöperation of this Commission." Furthermore moral and religious doctrines are scrutinized by the government. With such powers at their command, censors should be persons with wide understanding of society combined with a sense of humor which is essential to well-proportioned evaluation. But the fact is that persons of small caliber are often on the boards of censors.

**Radio Censorship.** Radio broadcasting is the most recent of the great new technological agencies for molding public opinion. Yet it reached an audience, in 1930, of 12,000,000 families. It is therefore of vital importance that a wise official policy be developed for controlling the radio medium. The formulation of such a policy is a purely Federal matter since national authorities have exclusive power to determine who shall and who shall not broadcast (p. 139). Ostensibly Congress has safeguarded freedom of speech over the air by enacting legislation which prohibits administrative officers from interfering with radio talks.

In reality the question is not settled so easily, since the exercise of control is physically necessary. Only a few hundred broadcasting plants can operate simultaneously in the United States, on present frequencies set aside for the purpose, without creating mutually obnoxious interference. As



applicants for broadcasting privileges considerably exceed this optimum number, certain of them must be disappointed or chaos will reign on the air. The denial of licenses to the unwanted applicants is based on the type of service they propose to render. Those whose projects do not please the examining officers are ruled off the air, subject to a final appeal to the judiciary. For instance, when the operators of KGEF asked for a renewed license in 1931 the Federal Radio Commission refused the permit on the grounds that they had promoted religious strife and criticized Los Angeles city officials and other prominent citizens. Limited governmental censorship of radio broadcasting is an established fact—an inescapable result of the workings of a necessary licensing system.

Occasionally rejected parties free themselves of American restrictions by setting up apparatus in Mexico, under Mexican statutes, and flooding the United States with programs in English. Several extremely high-powered stations of this type are now located just south of the international line, one being remotely controlled from Kansas. If Federal authorities should ultimately try to censor broadcasting programs in a rigid manner, these foreign plants would present great difficulties, since radio signals cannot be stopped and condemned at the border by national agents the way books or photographs can be.

Rapid strides in radio technology during the past few years bid fair to present us with still another problem in the field of liberty of opinion. Already experimental television programs are being broadcast nightly from a series of stations. Although the art is still very young, the problem of regulating it has received attention. Mr. H. A. Lafount, of the Federal Radio Commission, has declared that "without some sort of supervision, we can expect objectionable plays carried to the extreme being broadcast and received in our homes where young children can observe them." What is to be done about it? Apparently the path to censorship is clear,

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AN EVIDENCE OF THE CENSOR'S HAND  
Sign on a radio tower of station KGEF (see opposite page).



*Photograph by Acme Newspictures, Inc.*

### A NEW PROBLEM IN PERSONAL LIBERTY—DRUNKEN FLYING

The wreck that climaxed a wild flight over Los Angeles. The pilot, drunk but unhurt, was rescued by police from an angry mob of householders, whose lives had been endangered only a few minutes earlier. He was convicted of flying while intoxicated, an offense under California aviation law.



for the law preventing direct deletions from radio addresses by Federal officers does not apply to visual presentation. Furthermore motion picture censoring stands as a precedent for like supervision of the newer art. Senator King, member of Congress from Utah, has taken up the challenge, calling the attention of legislators to the need for formulating a sensible licensing policy before the impending evils are upon us. Here is a fertile field for thought on the part of those who enjoy speculating along original lines.

**Opinion in the Schools.** Government control over public opinion is particularly strong in the case of our educational system. State and local authorities, as managers of the great majority of the schools in the country, have a legal right to decide what subject matter shall, and what shall not, be taught to the rising generation. By this means the thoughts of millions of children are shaped with respect to public issues and private conduct. How the process can affect the scientific world is shown by recent Southern history marked by the legislative banning of opinion deemed heretical to the Fundamentalists in the Christian church. This sect insists that the Old Testament must continue to be taught literally as the Word of God in every detail, including the account of creation. But scientists generally argue that the sudden creation of man and beast is not proved by any of the methods of reasoning to which they are accustomed, and in their search for explanations of life various "heretical" theories are presented. One of these, known as the theory of "evolution," is the Darwinian claim that a series of changes has been taking place throughout time, evolving human beings from lower forms of life through a process of struggling for existence, natural selection and adaptation to environment. Darwinism had so many adherents and was discussed so freely that the Fundamentalists felt the time had come to check its progress in their territory. So they secured the passage of laws expressly forbidding classroom instruction in "evolution" in the public schools of three states—Ten-

nessee, Mississippi, and Arkansas. They succeeded in having a similar measure introduced into the legislature of Oklahoma and lacked but one vote of carrying another such measure through the Kentucky Senate after its approval by the House.

### FREEDOM OF OCCUPATION

**Historic Rigidity of Occupational Lines.** Paralleling the historic struggle over liberty of opinion has run another long conflict—that centering about the right to choose one's calling. In the Middle Ages there was little freedom of occupation. Serfs were bound to the soil; that is, forbidden to leave it. In the towns, fathers passed their crafts on to their sons with such monotonous regularity that their specialties became family names, as in the case of the weavers, millers, smiths, and carpenters. Gilds sprang up, monopolizing individual trades and penalizing persons who dared to work at them without joining the appropriate organization. The rigidity of vocational lines became unbearable in time and gave way from necessity, as technological progress stimulated the growth of the modern factory system. The latter created a demand for workers in the cities, bringing about wholesale shifts of population and destroying the restrictions on employment. The rank and file of adults, including women, acquired the legal privilege, at least, of selecting their tasks in accordance with their individual preferences.

**Occupational Restrictions in Modern Times.** Paradoxically however, technology, which in its early stages helped to break down rigid occupational restrictions, now threatens to force their general restoration. With the growth of specialization, the average adult has lost his ability to judge the capacities of the technicians whose services he wishes to engage and becomes prone to trust quacks with high-sounding qualifications. But if incompetents were permitted to practice in medical and engineering fields without restraint, a heavy toll of life and wasted money would be extracted from the country annually. If liberty to choose one's calling

was generally granted, would the public price be too high? Believing that it would be, responsible citizens have urged Federal, state, and local governments to weed the incompetents out of certain trades and professions through rigid systems of licensing, patterned somewhat after the gild qualifications of the Middle Ages.

**Extent of Modern License Restrictions.** The extent of modern governmental licensing for the various trades and professions is truly astonishing. The individual is ushered into this world, as a baby, by a licensed midwife or physician, perhaps in a ward at a licensed maternity hospital, attended by a licensed nurse. As a youngster, he receives a public school education with the help of licensed teachers unless his parents can prove that he is being educated otherwise. His health is looked after by licensed physicians, dentists, chiropodists, optometrists, osteopaths, and pharmacists. If he drives a car, he carries both a license for the vehicle and as a driver of it. Traveling by air, he either pilots his plane as a licensed operator or places his fate in the hands of a crew of licensed pilots and radio operators. On the water his craft is run by licensed officers from the captain down to the third assistant engineer. To marry he must get a license and have the ceremony performed by someone licensed to do it. Suppose he plans to build a house: he buys the land from a licensed real estate dealer as a rule, has it staked out by a licensed surveyor, and perhaps engages a licensed architect to design the dwelling. The drinking water is supplied through pipes installed by a licensed plumber from a dam constructed under the supervision of a licensed civil engineer. Electric current for lighting pulses through wiring put in place by a licensed electrician. For his recreation, if he wishes to fish he must secure a license; if he wishes to hunt he must have a permit to carry a gun and the dog which stirs up the game must be a licensed dog; if he attends the movies these are displayed by licensed projectionists. Nor does he escape the license system when he dies for he is prepared for



the grave or cremation by licensed undertakers, embalmers, and cremators.

Quantitative data have been provided by the Commonwealth Club of California, which recently discovered that 250 trades and professions are subject to license restrictions in one or more localities. *The Engineering News-Record*, in 1929, published the results of a more restricted survey, revealing that 21 states then had compulsory licensing laws for professional engineers. Altogether more than 27,000 individuals had registered as engineers under the several state statutes, New York topping the list with 8,500 licensees.

**Operation of the Licensing System.** Technical men in quest of such state or local licenses must pursue a rigid routine before the necessary papers can be issued to them. For example, persons seeking a professional engineer's license in California must go through the following procedure. An applicant communicates with the state board of examiners, proving that he is at least twenty-five years of age and of good moral character. He must next exhibit a record of six years' experience on engineering projects, at least one of which was spent in a responsible subordinate position. Graduates of engineering schools, incidentally, are permitted to count their four years in college as equivalent to four years in the field. But adequate skill is not always obtained through mere exposure to actual operating conditions. Consequently applicants must pass a three-day written examination in the bargain. As a third and last qualification, a thesis of several thousand words, dealing with a major project on which the applicant has served as an officer, must be submitted and approved. Only after each of these requirements has been satisfactorily fulfilled, and the set fees paid, will a license be made out.

Since the prime purpose of licensing technical men is to prevent incompetents from practicing, it is essential that the qualifications for licenses be reasonably high. Generally, standards have been low at the outset, so as not to disturb

unduly existing conditions, and have been gradually raised as the trade or profession gained in strength and sought to fortify its position. For example, civil engineers were originally able to obtain a license in New York State without having completed a grade school course. Noting the lack of suitable scholastic requirements, the state Department of Education threatened to classify engineering as a "vocation" instead of a profession. Aroused by this attitude, engineers urged the passage of a new law which made graduation from high school essential for a license. Perhaps the movement will go still further, for agitation is afoot in favor of making a college degree a prerequisite for engineering licenses, as is often the case with respect to law or medical certificates.

As the proud possessor of a license, the technician finds himself to be a member of a closed "gild," since competition from unlicensed individuals is eliminated through rigid state or local enforcement machinery. Sometimes examining bodies protect him by investigating complaints sent in by the public, naming persons practicing without valid licenses. At other times, the government may search for offenders directly: Florida dispatched an agent into the field a few years ago to scour the state for violators of her engineer registration law. Soon after the officer began his trip, an unusual number of individuals were seized with a sudden desire to take out licenses. However apprehended, guilty parties either are warned to desist or tried in court, depending upon the gravity of their offenses. An extreme case is that of an engineer who received a prison sentence in Oregon, during 1931, for performing technical work without a suitable license.

Having debarred from responsible positions technicians who do not hold licenses, the government polices the various trades and professions, making sure that licensees continue to merit their exclusive rights. In discharging this obligation, the more advanced states keep a close watch on registrants, administering punishment to those who conduct

themselves in an unseemly manner. Thus California suspends or revokes the licenses of professional engineers "for deceit, misrepresentation, violation of contract, fraud, or gross incompetency." Engineer certificates, in such places, are at once proof of inherent technical ability and testimonials as to character—an ideal combination.

Modern license restrictions obviously interfere with vocational freedom, by making it increasingly difficult to shift from one type of work to another. Furthermore they hamper travel from place to place, since a license to practice in one state or city may be worthless in another. Owing to marked geographical discrepancies in license requirements, one who tries to transfer his business to new locations may experience a great deal of inconvenience, or be defeated in fact. Truly, occupational liberty has been dealt a mighty blow by the coming of technological specialization.

### LIBERTY OF CONDUCT

From time immemorial reformers have set themselves the task of instilling virtue in the populace. In their zeal for success, they have often pressed the government into service, as in the notable case of the American experiment in prohibition. Opposing such elements are lenient groups who feel that individuals can be safely left alone in most matters of personal conduct. Arrayed with the latter are thousands of men and women who seem convinced that, whatever the theoretical desirability of sane living may be, political attempts at regulation are futile. This ancient struggle between factions is now entering upon its modern phase, a phase enormously complicated by the new technology.

**Sunday Blue Laws.** An excellent illustration of the effects of technology on official supervision of personal conduct can be traced in the history of our Sunday blue laws. Originally many of the men and women who settled along the Atlantic Seaboard, during Colonial times, were European refugees who had come to a virgin continent to escape



religious persecution. Living in homogeneous, self-governing communities, they regulated their own actions to fit their ideals. Since they looked with disgust upon all kinds of labor or frivolity on the Sabbath, it was only natural for them to express their disapproval by enacting formal legislation on the subject. The result was to place a series of blue laws on the early statute books, some of which survive to this day or have been reenacted. A typical example of such restraint, still in force in 1930, is an old New Jersey law. It reads: "No traveling, worldly employment or business, ordinary or servile labor or work either upon land or sea (work of necessity or charity excepted), nor shooting, fishing, sporting, hunting, gunning, racing or frequenting of tippling houses, or any interludes of plays, dancing, singing, fiddling or other music for the sake of merriment, nor any playing at football, fives, nine pins, bowls, long bullets, or quoits, nor any other kind of playing, sports, pastimes or diversions, shall be done, performed, used or practiced by any person or persons within this State on the Christian Sabbath or first day of the week, commonly called 'Sunday.'"

Application of such strict Sunday blue laws was possible in the age of simple living during which they were framed. But today the situation is very different. In order that we may cook our meals on the Sabbath, distant water-works, gas and electric plants must remain running. Motor cars and rapid transit lines must be kept in motion to carry us to and from churches or homes. We have become accustomed to reading Sunday papers or listening to the radio on Sundays. The public does not look upon the rendering of technological services on Sunday as sinful. A Puritanical attitude today would result in the closing down once a week of the essential facilities of civilization as now conceived, something not generally desired.

Yet tradition does not easily die. Every now and then zealots attempt to enforce the Sunday blue laws under modern conditions. A case in point recently occurred in

Irvington, New Jersey, a city of 48,000 inhabitants. Late in 1926 when two local movie houses proposed to keep open on the Sabbath, the clergy of the town, fearing that the shows would interfere with church attendance and demoralize the community as well, employed the old Sunday Blue Law as their legal tool for restraint. Strictly applied, the measure would forbid a whole series of enterprises besides the projection of motion pictures, such as the operation of street cars, buses, and trains. Druggists could not vend their wares. Restaurants could serve no food. A Puritan pall would again fall over society. Nevertheless, on the twelfth of December the campaign of repression began and ninety-eight persons were arrested for violation of the law. Then came a lull in enthusiasm for repression which lasted four years. It was followed by another wave of "reform." But this time policemen made no arrests, merely recording the names of persons selling gasoline, playing baseball or running a trolley car. That there is a lack of wholesale public support for these raids is proof of the revolutionary effect which technology has had on some of our notions about the relation between governmental control and conduct.

**Birth Control.** New issues have been raised in the field of personal liberty through the development of scientific means for birth control. There is general agreement that the very concept of a controlled population is fraught with mighty revolutionary implications. Hence an impassioned dispute arises about public policy toward the issue. Advocates of birth control in many instances favor the free dissemination of knowledge on the subject through the press and the post office, but some would only permit instruction by physicians. In either case, they emphasize the necessity for protecting women whose physical condition is such that they cannot stand the strain of childbirth; they call attention to the mortality among potential mothers caused by abortions, deaths running as high as 6,000 in the United States per year; they point out the number of illegitimate

children born annually in the country—30,000 on the average; they claim that the knowledge of birth control both provides a wholesome frame of mind for the individuals concerned and serves as a regulator of population, one of the prime considerations in plans for social welfare.

Against the birth control movement stands the Catholic Church, frankly hostile. The basic attitude of that body is summed up in the words of a recent Papal Encyclical on Marriage: "Since the conjugal act is destined primarily by nature for the begetting of children, those who in exercising it deliberately frustrate its natural power and purpose sin against nature, commit a deed which is shameful and intrinsically vicious." Lending additional weight to the same conservative stand are moralists who feel that a general distribution of knowledge on the subject of contraception would result in anti-social relations.

This highly controversial subject has been carried into legislative chambers. In 1873, when very little was yet known about birth control, a statute was passed by Congress excluding information on the subject from the mails. At a subsequent date, importation or interstate transmission of contraceptive devices or knowledge was expressly forbidden. In short, national authorities are pledged to do all they can to prevent the spread of the practice. On the whole, individual states have been more liberal in their attitude. A survey made during 1931 revealed that most of them permitted the dissemination of knowledge and the prescription of materials by licensed physicians. This is not an irrational restraint; on the contrary it helps to insure accurate and intelligent guidance. Forty-three states allow doctors to supply such data freely, although the circulation of books is not sanctioned in eleven of them. Among the remainder, constituting the last of the old guard, is Connecticut, where in 1931 it was still illegal to use contraceptives. By implication any medical man who offered clues as to their nature, as well as any druggist who sold supplies, was guilty of acting



as an accessory to the "crime." Even a limited amendment, letting down the bars in cases where the health of a woman might be jeopardized by childbirth, was voted down.

**Drunkenness in the Machine Age.** Hardly any public issue in modern times has aroused so much discussion and temper in America as the traffic in alcoholic beverages. At one time arguments on the subject were largely moral in tone but now the technological setting for liquor consumption figures largely in the debate—the necessity of maintaining sober persons at the controls of dangerous devices. Today we are surrounded by a great variety of hazardous mechanisms, such as our modern high-speed factory equipment, locomotives, airplanes, and automobiles. Even when he is in complete command of all his senses, the human being is often killed and mangled by machinery. Naturally his chances of escape are fewer when his brain is dulled by liquor. However it is because innocent parties are often injured that public action has been taken by means of law, supplementing trade union rules such as that regulating the conduct of trainmen, to safeguard life and property.

The several states commonly provide extra penalties for individuals found driving automobiles while intoxicated, in the form of heavy fines, imprisonment, or cancellation of licenses. Under Federal regulations, an airplane pilot may have his license revoked for "being under the influence of or using or having personal possession of intoxicating liquor while on duty." A similar national standard is applied to steamers, for a ship's officer may lose his license if he is discovered "under the influence of liquor or other stimulants to such an extent as to unfit him for duty." Applying its restrictions, New York State revoked 5,667 motor vehicle operators' licenses in 1930 for offenses committed while drunk. Whatever the form or fate of liquor control, with the repeal of prohibition, restraints on the manipulation of perilous machines and devices by intoxicated persons are destined to remain.

**General Limitations on Liberty of Conduct.** Restraints on liberty of person, such as briefly outlined in this chapter, are supplemented by many other forms of government control discussed throughout this entire volume. Regulations and prohibitions dealing with such matters as health, safety, sanitation, fair practices and rates on the part of utilities and private enterprises, pure food and drugs, honest weights and measures and composition in the case of chemical compounds also restrict the right of individuals to do as they please. Indeed hundreds of pages of statutes covering safety and sanitation in mines, factories, shops, dairies, packing houses, and other industries, regulating the use of implements and machines, controlling the discharge of wastes, gases, and fumes, and otherwise making legal prescriptions for the conduct of technological enterprises, all come under the head of personal liberty. If space permitted, a table containing literally thousands of items could be inserted, but enough has been said to show that technology has given new and significant aspects to the ancient controversy over personal liberty—aspects which will doubtless be explored in due time by political scientists who may be concerned with the effects of technical advances on social thought and practice.

## CHAPTER XVII

### PLANNING—CITY AND REGIONAL

**Plans in Government.** In all the institutions, laws, and practices described above there are evidences of plan, that is, operations and arrangements of things with reference to ends. Institutions for the enactment of laws, methods of law enforcement, taxation, budgets, finance, public works, public services, regulation of public utilities, encouragement of invention through patents, measures on behalf of public health and safety, and limitations on personal liberty all show a certain degree of planning to attain avowed purposes. Engineering, as pointed out in the first chapter, is essentially rational and planful in nature and operations; an engineer can start no important work without making a blue print—an exact plan indicating ways and means of accomplishing objectives posited in advance. Planning of some amount and kind is always associated with government and technology.

**Conflicts in Plans.** But in each case those who have made particular plans have usually concentrated their thought on their particular ends and given little or no attention to surrounding plans and operations. As a result there is often a great deal of conflict among plans and accomplishments, so that whole areas have the appearance of confusion, and individual designs are more or less defeated. Examples abound. One branch of the Federal Department of Agriculture stimulates increases in crop output and another branch spends millions of dollars in trying to induce farmers to curtail their crops. The Federal Government, by tariff legislation, encourages businessmen to build gigantic factories and then seeks feverishly in many directions for ways and means of enabling them to dispose of the enormous



volume of commodities they turn out. Special interests push government into undertakings that have no economic value or that exercise a detrimental influence on other enterprises; millions have been spent on useless waterways often to the injury of existing railways. Thus detailed planning frequently defeats itself or produces great friction and waste.

**Conflicts of Interests in Cities.** For many reasons confusion, waste, conflict, and defeat are especially noticeable in congested urban areas. Unlike many great cities of antiquity, almost all American towns have been developed without master plans controlling their growth and functioning, apart from the usual gridiron street design. There was no person or group in the United States strong enough or eager enough to impose any grand urban design. Many great cities of antiquity were laid out by monarchs to express their power and love of glory, and the flow of business or other activities had to comply with this requirement. Magnificence at least was achieved in some respects. But in the United States, as cities enlarged, businessmen, factory owners, real estate speculators, and home owners, each bent on particular enterprises, have built very much as they have liked, subject to few restraints in plotting cities and erecting buildings there. The growth of American cities in this individualistic era made for haste and waste, to say nothing of the disregard for urban life as a whole and for artistry.

**Rapid Growth of Cities.** The American city of today owes its loose expansion to the machine age, the development of the factory system having swiftly attracted millions of workers to industrial centers. At the same time, the invention of labor-saving devices for the farm had so enlarged the per capita agricultural output as to permit a heavy drain upon our rural population to occur without imperiling the food supply. The movement, as revealed in the records of the decennial census, is dramatic. In 1790 only three per cent of the inhabitants of the United States lived in cities and towns of over 8,000, as compared with forty-nine per

cent in 1930. Nor is this astounding migration at an end, although the process seems to be slowing down since the depression which set in with the year 1929.

### DISADVANTAGES OF UNPLANNED CITIES

**Ugliness.** Our cities have grown in a confused fashion, partly due to their attempts to care immediately for the steady flow of human beings from American rural areas and from many other parts of the earth. Inevitably this expansion has been accompanied by ills. Perhaps some critics will place at the head of the list of evils the ugliness induced by chaos. Where every individual is free to erect whatever type of structure meets his fancy, a motley collection of buildings expresses the social anarchy. Anyone who has entered an American industrial center through its back door, with his eyes open, has been annoyed by the rows of ramshackle wooden houses, messy yards, despoiled waterfronts, dingy factories and hillsides littered with huts patched together out of boxes and scraps of assorted metal. In contrast with these blighted areas may be found nearer the heart of the city a nobly conceived civic center, towering office-buildings suggesting aspiration, and stately tree-lined boulevards lending charm to the area. A jumble of squalor and splendor! Such is the character of the typical American city.

**Districts Blighted by Changes in Their Character.** The unplanned city is beyond denial an artistic nightmare. It is also the cause of an appalling amount of lost motion. A prime source of waste associated with haphazard metropolitan growth is the ruination of vast districts through alterations in the purposes to which they are put. That is, it is possible for a zone to assume a residential character at one period and a business or industrial character at another. The property damage resulting from such shifts is incalculable: buildings erected for one objective are rarely suited to other uses; residences are ill fitted to serve as factories; and offices

do not make satisfactory homes. When the nature of a section alters, block after block of buildings designed for one type of service must be rebuilt or torn down to make way for structures intended for another type of service, or allowed to stand in a state of decay. The Federal Department of Commerce estimates that millions of dollars a year are lost through the wrecking or abandonment of buildings, accompanying migrations of business, industrial, and residential districts. To the direct loss of the buildings themselves must be added a general lowering of neighboring property values due to the feeling of instability.

**Wastes in Utility Construction.** Wastes in the construction of utilities must likewise be charged against the lack of planning. Where any variety of buildings, of any height, may be erected at any time, the design of water, sewer, light, and telephone systems becomes guesswork. If plans are laid for one species of development in the near future and another kind actually takes place, the utility systems may prove to be either hopelessly small or unreasonably large—both extremes involving substantial wastage. Utility engineers who have tried to forecast conditions in planless cities protest against the continuation of such conditions.

**Traffic Congestion.** Planless cities suffer from traffic congestion amid all the other ills. The uncontrolled construction of skyscrapers facing narrow streets creates the need for rapid transit facilities. The building of these facilities encourages the erection of additional skyscrapers. An endless chain of needs is commenced. Then, too, the spreading of industry and business over wide areas starts the expensive cross-hauling of goods back and forth through the city streets. Narrow lanes, dead-ends, ill-placed terminal facilities, and grade crossings all help to increase the snarl.

### CITY PLANNING

**The City-Planning Movement.** Slowly the need for comprehensive planning to meet the problems so apparent on



every side won recognition at the hands of those concerned with the government of municipalities. The task was attacked from many angles. Specialists interested in esthetics gave consideration to the art of building "the city beautiful." Students of health, sanitation, and living conditions laid emphasis on housing. Economists and engineers, having primarily in mind transportation and other facilities favorable to manufacturing and merchandising, brought standards of efficiency to bear on the issue. By 1910 interest was so widespread in the United States that a city-planning association could be formed, and in a few years a profession of city planning had appeared. Shortly afterwards courses in the subject were offered in a few universities.

**Extent of City Planning.** Out of theory sprang practice. Cities began to have planning surveys made and plans devised. Action spread. By the opening of 1933, over 650 municipalities had city-planning commissions. Planning ordinances had been put into effect in 754 communities, comprising three-fifths of the urban population of the nation. Rigid restrictions forbidding property owners to do as they please have been generally upheld by the courts. In short, the movement toward engineering rationality in the modern city is off to a splendid start.

**Division of Cities into Zones.** The central feature of every comprehensive city plan is a zoning system. Out of the 85 cities having over 100,000 population in the United States, 71 have zoning ordinances. Briefly stated, zoning consists of the division of a municipality into "use districts," to each of which a special function is assigned. For instance, Pasadena, California, is split into five zones—one each for industries, business, single family dwellings, multi-family flats, and apartments or hotels. Larger places require a finer classification; smaller places may get along with fewer districts. Structures erected and maintained within any zone, if designed for a lower grade of activity than the regulations for that zone permit, may be removed by the



*Photograph by Spence Aerial Surveys, Los Angeles*

#### AIRPLANE VIEW OF A ZONED CITY

View of the southwestern portion of Pasadena, California. Note how the industrial and commercial districts stand out from the residential sections. No attempt has been made to differentiate between the three types of residential zones or to draw exact zone boundaries (*see opposite page*).



*Photograph by Brown Brothers*

### ZONING REGULATIONS FOSTER A NEW TYPE OF ARCHITECTURE

By their set-back provisions (*see* p. 509), municipal zoning ordinances have inspired a new and distinctively American type of skyscraper architecture, of which the Graybar Building, shown above, is typical.



strong arm of the law. This procedure was tried in Los Angeles where a brickyard was established above a valuable clay deposit. Seven years after the completion of the works, the neighborhood in which the plant was situated became a residential zone. The brickyard, being an industry, was ordered to move out and did so, taking with it all its equipment. Although such requirements inevitably restrict liberty of property, the courts have upheld them as essential for the common welfare.

The success or failure of a city plan, in fact the future of an entire metropolis, depends largely upon how wisely "use districts" are bounded and maintained. On occasion rival factions among local property-holders take matters into their own hands, wielding their political might with disastrous results. Let us suppose a case. Mr. A wishes to erect a garage or factory in the heart of a pleasant residential district. If powerful enough, he may succeed in having his individual lot or small group of lots designated as industrial. "Spot zoning," as this practice is aptly termed, can, if extensively applied, create the same jumble of adjacent stores, homes, and factories that existed in "the good old days" before there were local restrictions. To fight personal whims, to uphold a master program in the face of constant bombardment from vigorous antagonists, is a hard but vital task.

Yet a few advanced cities have undertaken this difficult task with encouraging success. Zones are laid out with care as to location. Industries are concentrated near important water or rail facilities, while homes are brought within reasonable traveling distance of both business and factory centers. But more is involved than position; proper size is also important. Surveys recently conducted in a series of municipalities indicate the approximate amounts of space required for major purposes. For example the percentage of developed area devoted to dwellings ranges from 47 in Minneapolis to 20 in Washington, D. C., with an average of 35

to 45. Commerce takes up 4 per cent of St. Louis and 1.4 per cent of San Angelo, with an average of about 5 per cent. Industrial coverage fluctuates from 26 per cent in Buffalo to 3 per cent in Evanston. Streets, parks, public buildings, and open sections occupy 44 per cent of Buffalo and 51 per cent of Memphis. These quantitative researches help planners to assign accurate acreages to each activity. Such absurdities as the reservation of enough frontage for business to care for a population ten times as great as can live in an urban community, under existing restrictions, may be thus avoided.

**Restrictions on Building Bulk and Shape.** Zoning ordinances do more than restrict the activities that may be carried on in the several districts; they also control the height and bulk of buildings. The maximum allowable height of structures varies with the zone involved. In El Paso, Texas, the height limit for business buildings is 125 feet, for apartments it is 70 feet, and for average residences it is two and a half stories. Peak elevations for the various sections are based on several factors. First there is the matter of the general character of a district. The maximum legal height of houses should be kept down in the ordinary type of residential neighborhoods whereas in the business district structures of considerable height are desirable in order to concentrate offices within a limited area. Secondly there is the consideration of sunlight. The street walls of buildings should not be run up so far as to shut off light and air from the thoroughfares. Neglect of this axiom has already been responsible for a number of dingy, canyon-like streets in New York and other cities. Thirdly there is the problem of traffic congestion. Buildings should not be permitted to grow so large as grossly to overburden the adjacent streets, or the rapid transit facilities for taking people to and from work. The crush of workers in the skyscraper portions of New York City, due to the tremendous capacity of certain towering buildings, has created a frightful situation.

Supplementing and modifying limitations on height are provisions for a reduction in the area of the upper stories of buildings. The El Paso, Texas, practice is to permit apartment houses to exceed the seventy-foot level whenever they compensate for increased elevation by a set-back of the street walls of two feet per foot of rise into the air. Incidentally the wholesale adoption of set-back regulations throughout the country, though originally intended to provide light and air and control bulk, has been mainly responsible for some superb architecture. The law, by compelling architects to depart from rectangular box-like structures, has led them to develop the alternative pyramidal type of building that has done so much to beautify the modern commercial city.

Having controlled the height and shape of buildings, the next task is to regulate the percentage of the area of any given lot that may be covered by structures. In residential districts it is obviously desirable to have every house surrounded by a yard. In El Paso, Texas, the city zoning ordinance requires ordinary homes to be provided with both front and rear yards, each twenty-five feet deep, and yards on both sides, each five feet wide. In the commercial zone, front and side yards are not made mandatory, the only cleared space specified by law being a rear yard ten feet deep, useful for loading purposes. The general appearance of an entire district can be markedly changed by modifications in the percentage of the lot area that must be laid out in yards.

**Adjudication of Zoning Disputes.** Unavoidably the exercise of such dictatorial powers over private property raises important legal questions. To handle these in a methodical fashion, the following procedure has been widely adopted. First, anyone wishing to erect a structure applies to the appropriate authority for a building permit. If the proposed undertaking complies with the zoning ordinance and supplementary design regulations, the request is granted. If the



contrary is the case, the petition is denied. Where a so-called zoning board of adjustment exists, an appeal may be taken to it. In the absence of such a body, or upon the rendering of an adverse decision by it, recourse can be had to the regular judiciary. Here the plaintiff usually seeks to prove that he has been unconstitutionally or otherwise unlawfully deprived of his liberty through the actions of municipal agents. Courts will not, however, grant relief unless there is sufficient evidence that existing use districts have been improperly laid out. Favoritism, haphazard planning, or undue rigidity are a few of the legitimate causes for voiding specific zone requirements. Comprehensive zoning, then, is not merely desirable; it is necessary in order to assure the sanction of the courts for city plans.

**Street Plans.** With the activities to be carried on in the various parts of a city stabilized by law, and the bulk and capacity of buildings likewise limited, the probable load upon city streets may be approximated. It then becomes possible to develop a comprehensive street plan so as to afford proper transportation facilities for all parts of the metropolis. The basic element in such a plan consists of rectangular blocks, laid out in gridiron fashion where the topography is favorable, over large areas of the city. Steep hills are, naturally, accorded special treatment to avoid the presence of dangerously sharp grades. Superimposed upon this gridiron, should be a system of radial routes, running out in many directions like the spokes of a wheel, and connected at intervals with belt lines, resembling the rim of a wheel. Such a combination in general proves ideal. The gridiron admits of the erection of economical rectangular structures and facilitates the finding of addresses. The radial routes admit of rapid diagonal movements across the city. The belt lines perform somewhat the same function, with the added advantage, in the outlying sections, that inter-city through-traffic may follow them around built-up sections, thereby detouring the congested centers of great cities.

All the leading comprehensive street plans entail the construction of highways at tremendous cost. Sometimes action must be taken to penetrate existing barriers, such as rivers, swampy tracts, railroad yards, or congested blocks of buildings. Where the older routes are properly located but adapted to very small volumes of travel, they must be enlarged. The widening of streets, to increase their carrying capacity, has become a necessity in many big cities. Even though broadening operations may involve the wholesale condemnation and wrecking of structures, the improvement may still be justified by the results achieved. The Olive Street widening in St. Louis, for instance, increased property values by a full 700 per cent. Of course even widening has its limitations, especially in skyscraper sections. As an alternative, resort may be had to the double-decking of streets. An outstanding example of a two-layer highway is Wacker Drive, in Chicago, where trucking is assigned to the lower level, while lighter passenger travel is on the top deck. A similar project consists of an express route along the Hudson River in New York City, elevated over a busy street full of harbor drayage. The raising of streets, by carrying traffic over intersections, greatly increases the speed of travel, while providing additional lanes. The millions of dollars now being spent for engineering works of this character emphasize the importance of intelligent, comprehensive street plans.

**Control of Real Estate Subdivisions.** Street plans, being prepared with an eye to the future, must reckon with the private real estate subdivider. If the owners of large neighboring tracts are left perfectly free to lay out roads in any fashion that meets their fancy, chaos may result when those roads impinge as parts of the general municipal highway system. If the private platting is done without proper regard for topography, the grades of certain routes may be unduly severe. In Little Rock, Arkansas, two streets were actually surfaced, even though it was clear that they were so steep that cars could neither ascend nor descend with safety.

Where private plans are made with slight attention to present connecting roads, the product may easily be a variety of dead-ends, unnecessary windings, constrictions, and staggered corners, all destined to interfere with future through-traffic. In recognition of these difficulties, subdividers are now often required to obtain official approval of their street layouts before proceeding with construction. Recalcitrant realtors, refusing to submit maps, may find it impossible to secure municipal water and sewer connections, or building permits for the erection of houses, even when the local ordinances do not specifically authorize the municipal review of platting. Whatever the ruse, the government, on winning the power of review, orders private roads to be straightened, widened, realigned, and leveled so as to fit them into the comprehensive street plan. Only by careful checks of this sort can the general street system be forced on gigantic private suburban developments.

**Rapid Transit Plans.** Modern American metropolitan areas require the services of various forms of mass transportation by bus or rail, in these days when it has become utterly impossible to carry the requisite number of persons to and from work by private conveyances. A study made in the City of Detroit, Michigan, is most revealing on this point, showing that in the peak afternoon rush hours, eighty per cent of the passengers traveled by street car or bus as against twenty per cent in private automobiles and taxicabs. Comprehensive city plans, therefore, involve the careful coordination of elevated, subway, bus, and trolley lines, in order that the centers of great cities may be rendered accessible from the ever-spreading suburbs. A number of notable surveys have been made by governmental agencies to this end, surveys capable of direct application, owing to the power vested in state and municipal authorities to control transit routes by public service franchises (see p. 423).

**Freight Facilities.** Comprehensive city plans must foster the development of facilities for supplying industrial and



commercial districts with materials as well as with executives and workers. The former result can best be secured through the careful planning of steam-railroad systems. All too often each individual line, upon reaching a given metropolis, has established its own separate facilities, with slight regard for the projects of rival companies. The result has been poorly located competing terminal and yard systems in the manufacturing and marketing zones of leading cities, with inadequate provisions for the transfer of cars between yards. In connection with rail development, cities located on navigable waters must give attention to harbor facilities for ships. In such cases rail lines should be thoroughly linked up with piers so as to admit of the rapid transfer of goods from vessels to cars and *vice versa*. Efforts in the direction of orderly port development have received considerable impetus in recent years from the growth in the government ownership of entire harbors (p. 366).

**Parks, Parkways, and Playgrounds.** Turning from purely "practical" matters to recreation and beauty, still other phases of comprehensive city planning are revealed. A comprehensive plan provides for a wise distribution of parks, parkways, and playgrounds throughout the metropolitan district. The genuine emotional release offered to urban dwellers by tracts covered with trees, shrubs, lawns, lakes, and athletic facilities is so fundamental that every important city has seen fit to underwrite an extensive park program. The beautification of waterfronts forms a conspicuous part of many such projects, having its justification in the fact that often, in the past, waterfronts have been permitted to degenerate into unsightly dumps or aggregations of dingy huts and industries. Waterfronts can be made extraordinarily attractive, with proper effort. The lake shore development of the City of Chicago, Illinois, involving a driveway, lagoons, beaches, parks, and an outer island, is an excellent illustration of what may be accomplished in this direction.

**Public Buildings.** Through the municipal ownership and operation of park systems, cities have a splendid opportunity to improve their whole appearance. In furtherance of this same objective of beauty, comprehensive city plans regularly provide for a judicious distribution of public buildings. Metropolitan areas require a variety of local governmental structures—schools, courthouses, fire stations, police headquarters, city halls, monuments, museums, free libraries. Wherever located, they should be afforded a high grade of architectural treatment. Often a number of these local buildings can be grouped together in a harmonious fashion about some central square, constituting a civic center. In several instances larger units of government, Federal, state, and county have their offices in a city civic center, while in a few cases non-governmental enterprises, such as union terminals or private museums, coöperate in the projects. Whatever the line-up, a civic center serves as a visible beginning of community interest and pride in government. It also has the eminently practical effect of improving efficiency through a concentration of agencies that facilitates inter-office communication.

**Signs and Overhead Wiring.** While it is a relatively easy matter for the government to design its own parks and buildings with an eye to beauty, the problem of overcoming shabbiness in private structures is far from simple. The few attempts that have been made to improve the appearance of the average street have been largely confined to the control of indiscriminate advertising and overhead wiring. In Denver and Rochester art commissions have charge of the granting of all permissions for the erection of overhanging commercial signs. In Buffalo and Kansas City, the restrictions are even more severe, overhanging signs being totally forbidden on certain specified boulevards. Few who have viewed the jumble of words and figures that so often constitutes the bulk of sign advertising mourn the loss. The unsightly appearance of overhead wires, too, has received

direct attention from governments. Several cities now require the tangle of poles, wires, and other fixtures carrying electric current above the streets to be taken down and replaced by underground conduits. In Springfield, an act of the Illinois legislature directs that wires within two miles of Court Square be put beneath the pavements. In Detroit the city government has adopted a progressive program of compulsory wire removal. By such means, some of the lesser eyesores in metropolitan areas have been partially eliminated.

**Architectural Control of Buildings.** The much bolder step of regulating the architecture of private buildings has rarely been taken. The first genuine example of city control over the beauty of structures in general was the work of the local government of Santa Barbara, California, following a severe earthquake. There an official board of review exercised its generous regulatory powers in securing a harmonious rebuilding of the business district in the Old California style. All in all, some two thousand building permits were issued before the ordinance creating the board was finally repealed. Pursuing a like course, the town of Saint Charles, Illinois, recently provided in the building code for a governmental committee "to pass upon the architectural design and arrangement of all buildings to be hereafter erected or altered." Not so sweeping in scope but nevertheless effective is the work of the Art Jury of Philadelphia in controlling the appearance of buildings bordering on the famous Fairmount Parkway. Such efforts may possibly mark the beginnings of a new era of common supervision over construction in the interests of civic beauty and pleasure. At any rate the development is encouraging.

**The Slum Problem.** Concerted drives on the slums which disgrace most American cities would go a long way towards improving urban centers and furnishing decent housing for the people. Yet few governmental units seem prepared to face the issue. New York State has made a modest move in this direction by encouraging the construction of inex-



pensive modern tenements equipped with up-to-date facilities. Under her enabling act, limited dividend companies may be formed for the purpose, receiving not more than six per cent on their investment and charging not over \$12.50 per room per month. All such concerns must have the formal approval of the State Board of Housing before beginning operations, and must give assurance that they will stick by their ventures during the whole of a twenty-year experimental period. To help them in their battle with ramshackle dwellings, special favors have been conferred upon them. All their property, except land, and their security issues are free from taxation, and they can exercise the right of condemnation over private holdings when necessary. Already an investment of \$9,000,000 in these undertakings has provided accommodations for 1,700 families. Nevertheless they represent only a small beginning in a sadly neglected municipal field.<sup>1</sup>

**Cities of the Future.** As we have already stated, problems arising out of our industrial civilization have forced municipalities to embark on extensive city-planning ventures. Will these governmental efforts some day seek to take fuller advantage of the potentialities of technology? Will local authorities simply foster the erection of more and more absurdly complex aggregations one hundred years hence, or will they have a large conception of social living for town and country people? Opportunities for novel experiments abound. One common variety of imaginative design portrays skyscraper conglomerations, composed of structures reaching toward the clouds, and pierced at all angles with tier upon tier of motor roads. Projecting perilously from the flanks of the tall towers stand airplane landing-fields. Such suggestions, taking their inspiration from the mounting office-buildings and hotels of New York City, represent the ultimate in mechanized urban congestion. Following an alternative path, Le Corbusier depicts a weird mechanical

<sup>1</sup> For emergency housing legislation of 1933, see below, Chapter XVIII.

species of city, in which a broad, cleared tract is dotted at regularly spaced intervals with multi-storied slim towers. The towers are to shelter the necessary population but are to occupy only a small percentage of the total ground area. The rest of the surface is to be covered with beautiful gardens and parks, criss-crossed with motor roads. Let us hope the city planners of the future will have the vision to employ the mighty potentialities of technology to the best social ends.

### COUNTY, REGIONAL, AND STATE PLANNING

**County Planning.** Having many achievements to their credit in plans for individual cities, bold spirits were encouraged to try their skill on a broader scale and during the last decade county planning has appeared as an associate of city planning. Official bodies have been formally created to prepare comprehensive programs for many counties, of which Los Angeles, Milwaukee, Lucas (Ohio), and Glynn (Georgia) are typical. Their operations are akin to those of similar local authorities. Thus Los Angeles County has adopted an ordinance under which scattered sections of unorganized territory, ranging from two to eight square miles in size, have been zoned. Integrated transportation systems have also been laid out on paper—witness the general highway maps for Los Angeles.

**Official Regional Plans.** As it happens, several of our leading metropolitan centers spread out over two or more counties. Coördination of planning activities for such regions requires the creation of special authorities. Only a few of these are of official origin. Notable among them is the Niagara Frontier Planning Board which has initiated zoning, park, highway, water-supply, and sanitation programs for the vicinity of Niagara Falls. Performing work of a like character in an area adjacent to Washington, D. C., is the Maryland National Capitol Park and Planning Commission. Operating in a single field, the Port of New York

Authority has endeavored to develop a comprehensive transportation system for sections in New York and New Jersey composing the country's greatest harbor.

**Private Regional Plans.** However, the difficulties involved in setting up official bodies to regulate the work of scores of independent communities within great metropolitan districts are grave indeed and where they cannot be readily surmounted for the moment some private agency may step in to fill the gap as best it can. Thus with the aid of a generous gift, the Regional Plan of New York and Its Environs has performed a signal public service. It has closely investigated the area surrounding our major seaport with a view to drawing up a logical plan for the whole territory. This program is now complete and is being periodically revised to be ready for instant use. Two additional private agencies—the Regional Planning Federation of the Philadelphia Tri-State District and the Chicago Regional Planning Association—are engaged in corresponding activities in their respective communities. From cities to counties, and now to regions, has spread the idea of orderly development in industry, trade, housing, and social arrangements.

Even regional planning is too narrow in its scope to meet every modern need. Primarily concerning itself with individual metropolitan centers, it pays slight attention to the maintenance of a proper balance between them and great rural areas. We have traced the movement from farm to urban life. Already nearly half the population of Illinois resides on one per cent of the land—in Chicago and its vicinity. Has this shift gone too far? No less an industrial leader than Henry Ford believes that it has: "The overhead expense of living in such places [big cities] is becoming unbearable. The cost of maintaining interest on debts, of keeping up water supply, sewerage and sanitary systems, the cost of traffic control and of policing great masses of people is so great as to offset the benefits of the city. The cities are getting topheavy and are about doomed." What



then? With super-power nets, movies, the radio, automobiles, and other modern conveniences reaching out into the country, a redistribution of population is becoming increasingly feasible. Mr. Ford suggests taking advantage of this development to decentralize economic and social activities in small communities. John Nolen, an accepted authority on municipal affairs, is of the opinion that a town containing from 30,000 to 50,000 inhabitants is near the optimum of size. Some of the great industrial companies are now contributing to the reversal of flow by locating plants in minor places on the assumption, in part, that greater efficiency can be thus achieved.

**State Planning.** State governments, interested in the welfare both of urban and rural sections, cannot indefinitely ignore these important trends. Already a few of them have collected data for comprehensive programs covering their entire jurisdictions. In 1925 the Commission on Housing and Regional Planning, created by the state of New York, published a progressive report dealing with the advisability of redistributing population. It sought to point out in a general way the sections that should be preserved for industry, for farming, and for forests, respectively. Michigan has inaugurated a similar study of land utilization. After the Chamber of Commerce began like labors in Illinois, the governor appointed a State Planning Commission to carry on the work. Basic material is now at hand for state-wide zoning. Wisconsin has even organized a special authority with a view to controlling development along her leading river valleys. More limited in scope, but still lending strength to the movement, are several other ventures. For example California has completed a painstaking investigation of her water resources. The total potential supply, the sites of reservoirs and aqueducts, and the proper type of consumption for each region have been outlined. Integrated schemes for parks and highways adequate to meet the hurried tempo of modern life are being proposed.

**Growth in the Concept of Planning.** History reveals a remarkable broadening in the vision of American planners. Once it was thought that the mastery of chaos in such a small unit as a city was a mighty accomplishment. Now we observe not only cities but counties and regions as well embarking on comprehensive programs of rationalization. As the movement broadened, state governments began to take steps, halting to be sure, in the direction of state-wide planning with the object of uniting industry and agriculture, forestry and parks, highways and waterways in a general scheme of economy. And before the states had advanced far on the way, the conception of nation planning appeared, to be followed quickly by action on a stupendous scale under the National Recovery Act and other sweeping measures of 1933. Although this latest phase of planning is too new to admit of satisfactory valuation, its significance is so great that it must now receive detailed treatment of its own.

## CHAPTER XVIII

### NATION PLANNING—THE INTEGRATION OF ECONOMY

**Conditions of Technological Operation.** From the above review of the relations between government and technology certain major facts stand out in clear perspective. Government itself has long carried on various and numerous scientific and technical operations. Many of these are connected with what may be called the “natural” or historic functions of government, such as national defense. Others grow out of services rendered to the public, such as the supply of water, gas, and electricity in certain communities. Besides carrying on technical operations on its own account, government has long regulated more or less closely the operations of private industries. It has controlled rather minutely the rates and services of public utilities, so-called, and it has prescribed safety and sanitary regulations for various industries outside the public-utility field. These functions of government pertaining to engineering enterprises have been growing rapidly in recent years, entirely apart from any conceptions of planning in economy or measures designed to meet national emergencies.

Yet, in spite of the increase in government control, the major portion of technological undertakings remained in private hands, subject only slightly to government prescriptions. It is true, as already noted, that government has all along defined the objects of private property—lands, forests, minerals, water-power sites, and so forth—with which technological operations are carried on; but in defining objects of private property government has left a large degree of freedom to individuals and concerns in using their property



and distributing the fruits of use. In determining its relations to private property, government has generally followed historic rules applicable in the older system of handicrafts and man-power existing before the rise of gigantic technological industry. In Great Britain, these rules were reduced to a system by Adam Smith in his remarkable work, *The Wealth of Nations*, published in 1776, the year of the Declaration of American Independence—at a time when handicrafts were still dominant in industry and the factory system was in its infancy.

**Theory of *Laissez Faire*.** During the early days of the factory system in England, economists, with Adam Smith in the lead, formulated a general doctrine for all industry, known as *laissez faire*—the government should let industry alone to carry on its own affairs in its own way. According to this theory, competition is the life of trade and governments should in no wise interfere with the free play of this great force. In the absence of political regulation, open rivalry for business would induce concerns to place the highest quality of goods and services on the market at the lowest possible figures. Monopolies were inconceivable. As soon as a large trust attempted to raise prices unduly or lower the quality of goods, in order to reap exorbitant profits, it would automatically invite corporations into the same field—companies content with smaller returns—which would soon produce articles for less and cause the collapse of the “unnatural” combination. In short, if everyone was left to operate as he pleased, the country and the world would be well off. The principle won supremacy among British classical theorists and became a guide for American thought as well.

### THE ANTI-TRUST MOVEMENT

**Government Interference with Free Competition.** *Laissez faire* doctrines have never been given a perfect trial in the United States; on the contrary, the government has inter-

fered with the free play of competition since the foundation of the Republic. For example, Federal authorities issue patents which vest in their holders the exclusive right to exploit inventions for seventeen years (p. 445). Not only is the sale of consumers' commodities affected thereby, but the manufacture of complex machines is vitally restrained. Frequently a large group of related patents is bought up by a giant combination, which thus obtains what amounts to legal control over a whole industry. Since the major share of the country's manufactured products are patented in whole or in part, the monopoly features of the system act as a strong brake on normal business rivalry.

Other instances of government interference with the free play of competition may be briefly summarized. As the wastefulness of open rivalry in the public-utility field has become increasingly apparent, Federal, state, and local governments have granted to individual corporations the exclusive right to supply particular services in specified areas (p. 423). Tariffs lend "unnatural" encouragement to home industries by giving domestic producers a strong advantage over foreign plants. National subsidies to air mail lines have helped them to survive in their pioneering fight with the railroads. Tax exemption, offered by states or cities to companies as an inducement to move factories into new territory, enables a few favorites to save overhead. Finally the government itself, through its ownership of various enterprises, may divert trade from private parties.

**The Trusts Destroy Their Rivals.** While American governments have undoubtedly done a great deal to hinder the free play of competition, they were not solely responsible for the formation of powerful combinations. Even without official aid, a number of corporations have not only succeeded in gaining substantial control of certain major lines of industry but have held them in subjection for long periods of time. Frequently this result was attained through the relentless destruction of small rivals, in the course of ingenious

financial or other manipulations. For example, the early Standard Oil organization kept trained observers in the field, collecting elaborate data on the strength of opposing companies. Its petroleum quotations were varied to meet the local conditions thus revealed. Sales prices might be cut below the actual cost of production in a given territory, and held there until little concerns with small financial reserves were driven into bankruptcy, one by one. Deficits incurred in the performance were covered by charging high prices for oil in regions where the trust completely dominated the scene. To disguise its hand, the rapidly expanding combination set up bogus "independents," ostensibly fighting their own personal price wars with petty dealers but actually serving as advance guards for central headquarters. Once rid of obnoxious enemies, the trust boosted its rates as it pleased, satisfied that minor concerns had learned the futility of risking their money against such odds. Clever work of this kind makes it possible to evade the simple laws of economics upon which *laissez faire* doctrines are built.

**Anti-Trust Movement.** Under the pressure of governmental favors and private financial manipulations, free competition in many lines was being rapidly driven from the American scene before the close of the nineteenth century. Advocates of *laissez faire* saw that if this trend was allowed to continue, sharp business rivalry would virtually disappear, and with it their whole theory of economy. Spurred to action by the critical situation, they organized a counter-movement aimed at restoring a vigorous but "fair" battle for sales among small businessmen, to reduce prices to a reasonable level. Although theoretically opposed to government interference with industry, these individualists realized that their program necessitated official aid. The force of law could alone break up the host of trusts then in full operation or properly penalize concerns employing questionable tactics. So powerful were these reformers that they compelled one state after another to pass stern



laws forbidding certain common varieties of trade restraint—usually “all combinations in restraint of trade.” Even Federal authorities were brought into line, Congress approving the famous Sherman Act in 1890 and the Clayton Anti-Trust Act in 1914, thereby paving the way for the dissolution of concentrations of interests operating on a national scale in interstate commerce. True, these new measures did not attack the whole problem of monopolies, for they did not abolish the patent system or cancel exclusive public-utility franchises, but they did mark definite efforts to restore free competition.

This legislation makes many combinations in restraint of trade illegal. Organizations coming under the ban may consist of a single concern or of a series of companies tied together through interlocking directorates. Whether or not trade is being restrained is for the courts to decide in final analysis, after prolonged investigation of the extent to which the market has been cornered and prices maintained. If the judges find an enterprise to be operating in violation of the law, they may order its dissolution in accordance with a comprehensive plan. For example, one of the major industrial concentrations split up by judicial decree was the so-called Powder Trust. This Trust was replaced by three rival agencies, the E. I. Dupont de Nemours Powder Company, the Hercules Powder Company, and the Atlas Powder Company, the forty-three plants of the original Trust being equitably distributed among them. When the United States Supreme Court broke up the Tobacco Trust, it decreed that fourteen independent concerns should be established in its stead. In a similar fashion the Standard Oil Company of New Jersey was divested of thirty-seven subsidiaries. Units thus succeeding the parent administration are supposed to engage in open competition indefinitely.

Anti-trust legislation was intended to do more than break down the large industrial combinations; it was designed to prevent their formation as well, by regulating general

competitive tactics. For example, national statutes grant to the Federal Trade Commission the power to approve and enforce reasonable standards of fair practice, covering the field of interstate commerce. Thus the reduction of prices to favored customers, with or without the stipulation that they cannot handle competing commodities, is forbidden. When a factory tried to defy the rule by selling cans to a packing concern at twenty per cent less than it charged a second plant for the same grade of containers, the latter petitioned the Government for, and won, a lower quotation on the ground that the original price constituted unjust discrimination. So, too, a group of lumber companies were compelled to stop advertising Philippine mahogany which, although it had the appearance of mahogany, came from a wholly different tree.

Subject to the liberalizing qualifications of the National Recovery Act of 1933 (below, p. 535), violators of anti-trust legislation are liable to severe penalties. For instance, companies convicted of employing unfair methods of competition to injure their rivals can be ordered to pay the parties harmed thereby an amount equivalent to three times the damages sustained by the latter. Again, the charters of transgressing corporations may be revoked, automatically forcing them out of business. To cap the climax, offending concerns may lose important property rights. Thus purchasers of articles sold in defiance of fair practice rules are free from any obligation to pay for the same. In many cases the government is empowered to go a step further and seize goods in transit, provided they are moving under contracts in restraint of trade. Commodities so confiscated may be disposed of at official pleasure, without compensation to the manufacturer. Yet despite the attention given to drawing up severe anti-monopoly measures, concentration of industries continued to flourish. This condition is due in part to the forbidding size of the task of preparing for trial all the necessary documents, in part to laxity in enforcement, and

in part to the growing belief that the effort is unwise, if not futile.

#### ATTEMPTS TO SAVE THE COMPETITIVE SYSTEM IN THE DEPRESSION AFTER 1929

**Production Outruns Consumption.** Advocates of *laissez faire* expected that the breaking up of giant combines and the restoration of freedom of competition under the anti-trust laws would place the nation on a sound economic footing. On the surface it seemed that they were right, for industry proceeded at a fairly even pace, marred only by a few self-healing cycles of depression. But appearances were deceptive. Mighty technological forces were beginning to undermine the old order. Inventors were quietly introducing one new labor-saving machine after another. For example, a device capable of turning out 250,000 bottles in twenty-four hours replaced the painstaking system of hand blowing. Modern tractor-drawn drills appeared on the market that could sow an acre with grain in fifteen minutes, as compared with the four and a half hours required to do the same task by the methods of our forefathers. Workers can now make almost a thousand times as many bricks in a day as their predecessors of two centuries ago. A 1933 mill can prepare 30,000 barrels of flour a day per operative, whereas the miller of the Middle Ages was lucky if he ground two barrels a day. A plant with 208 men can assemble the frames of 10,000 automobile chassis from dawn to dusk. The per capita horsepower of prime-movers has risen from one-half in 1849 to over 10 in 1934. From farm and factory flowed a veritable flood of goods, far exceeding in volume anything ever witnessed before in the history of the world.

Under the competitive system, there was nothing to restrain the movement towards greater and greater output. Before long plants were ready to turn out more goods than citizens wanted or at all events could pay for. Production definitely outran consumption or at least buying power.



American automobile factories, for instance, had a capacity almost 100 per cent above current domestic demands in 1926, while rubber tire factories were overbuilt 1200 per cent and shoe factories 80 per cent. The distributing system, notoriously inefficient to start with, was unable to dispose of commodities as fast as they could flow from the mills. Sooner or later there was bound to be trouble. The crash of 1929 brought it in full measure. Citizens quickly lost a large percentage of their purchasing power; sales channels, too small to carry full production in normal times, now shrank still further. Plants were forced to shut down for lack of business, throwing their employees out of work and crippling still further their buying ability, which in turn took away more trade and closed down additional plants. Enterprises still operating had so much difficulty meeting expenses that they had to introduce more advanced labor-saving machinery to make a profit, displacing thousands of men and women. The depression of 1929 was gathering momentum.

By the dawn of 1933, a large proportion of our industrial machinery—about fifty per cent—stood idle. A few random figures are indicative of the situation. Malleable casting plants were running at 15 per cent of capacity, steel barrel works at 21 per cent, glass container factories at 51 per cent, and steel ingot centers at 18 per cent of capacity. Nor was agriculture in much better shape than manufacturing, for farmers were dumping milk by the ton or burning wheat to get rid of their "surplus." According to Harry L. Hopkins, Federal Emergency Relief Administration head, over 20,000,000 persons were dependent on charity in March, 1933. Hungry, weary, and discouraged, a vast nomad horde wandered from city to city in search of work. Begging, borrowing, or stealing bites to eat, living in "jungles" made out of old boxes and assorted rubbish, suffering from lack of medical attention, thrown in jail as vagrants, they barely kept themselves alive.

**Minimizing the Depression.** Since Federal and state governments had aided in maintaining such free competition as existed, through the enforcement of the anti-trust laws, they had a deep interest in the preservation of *laissez faire*. A sudden reversal of policy was not believed wise at first. So they adopted a policy of watchful waiting, in 1929 and 1930, hoping that the economic disease would heal itself as panics in the past had done. In the bargain, they applied a little mass psychology, to fan the rapidly dying embers of prosperity enthusiasm. President Hoover informed the nation that "the fundamental business of the country—that is, the production and distribution of commodities—is on a sound and prosperous basis." As 1930 opened the Secretary of the Treasury, Andrew D. Mellon, announced that there is "every confidence that there will be a revival of activity in the spring." In January, 1930, President Hoover saw employment already taking a turn for the better. On March 3, the Secretary of Commerce, Robert P. Lamont, assured the country that business would be normal in two months. When summer came, President Hoover estimated that business would be normal by autumn. But "normalcy" did not return.

**Campaigns to Increase Purchasing Power.** Mere pronouncements were obviously ineffective. President Hoover, therefore, tried more positive action in his campaign to encourage the return of prosperity without fundamentally altering the economic policy of the Government. He appointed a national committee to stimulate artificially demands for goods and services throughout the country. Employees who enjoyed a steady income were officially urged to spend money as freely as possible. For the benefit of those with sluggish mentalities, lists of ways and means of spending money were distributed, suggesting such items as the repair and painting of homes, the restocking of wardrobes, and the mending of socks. A parallel campaign was launched among employers to induce the latter to maintain high wage

scales and take on additional men as fast as they could, thus swelling the buying power of the people to the limit of their ability. However the experiment was largely in vain, since individuals who were in constant fear of losing their jobs held tightly to their pocket-books in preparation for a rainy day. Similarly, factories suffering from shrinking sales were far more apt to slash salaries and reduce forces than do the opposite. So private consumption failed to rally.

Finding private parties unable or unwilling to loosen their purse strings, plans were laid in President Hoover's administration for greatly increasing government expenditures. Federal, state, and local agencies undertook extensive emergency programs of public-works construction, giving thousands of men jobs on new projects, and moving hundreds of carloads of supplies on the open market. However the resultant growth in purchasing power was relatively slight, when compared with the enormous unemployment problem that remained. Determined to drive activity in this direction to the limit, under President Roosevelt, Congress voted an appropriation of \$3,300,000,000 in 1933 to pay for a record-breaking series of undertakings. The funds so created were spent rapidly on national operations and on those of states, counties, and municipalities, with a Federal bonus in the form of gifts up to thirty per cent of each outlay.

**Stimulating Buying through Government Loans.** Neither requests to private parties to spend more money nor lavish public-works schedules seemed sufficient to turn the wheels of industry at their accustomed speed. So the Government embarked on a program of money-lending to help individuals and corporations that were willing to expand their purchases, but were unable to borrow the necessary funds from regular financial houses. Millions were lent to railroads and other enterprises by the Federal Reconstruction Finance Corporation. Thousands of homes were saved from mortgage foreclosures with sums secured from a Federal agency



created for the purpose—the Home Owners' Loan Corporation. Then a Federal guarantee of bank deposits of under a certain amount, effective January 1, 1934, was adopted for the purpose, in part, of enabling crippled banks to "thaw" their "frozen" deposits. Millions upon millions of dollars were thus pumped into circulation through official action (above, p. 286).

**Stimulation of Buying by Raising Prices.** Still another method of stimulating buying was tried. When prices are rising, so the theory runs, people are induced to lay in supplies at once, fearing that a delay may prove costly to them. Merchants receive a larger margin of profit. Business tends to revive. Taking advantage of this supposed phenomenon, the Roosevelt administration embarked on a concerted campaign to lift prices to the level of 1926, a fairly prosperous year. As a first step in this direction, the United States officially abandoned the gold standard, leaving American currency with no other intrinsic value than that represented by a fractional backing of silver. Not content with the resultant drop in the dollar, President Roosevelt ordered the Federal treasury to acquire gold on the open market at abnormally high quotations, late in 1933. Despite such methods of depreciating the dollar, commodity prices still lagged behind the 1926 peak, and trade certainly did not rally immediately to an encouraging extent. On the contrary, there was evidence that monetary instability of this type tends seriously to upset industrial plans and perhaps retard recovery.

**Direct Relief of the Unemployed.** Along with varied attempts to stimulate the revival of business, measures had to be taken to alleviate the suffering of the army of unemployed. In previous depressions the task of caring for such unfortunates had been mainly thrown on private charitable organizations. During 1933, however, these agencies were so heavily burdened that they had to turn away untold thousands of needy cases from their doors. Governments were

finally driven to the rescue. Prominent among the relief bodies created by the United States Government for this emergency was the Federal Civilian Conservation Corps, which recruited young men, fed, clothed, and housed them and put them to work in the national forests principally. During the winter of 1933-1934 the Federal Civil Works Administration paid men for such work as building highways, teaching, fighting pests, and aiding fisheries. States also lent aid to the destitute, financing their enterprises from an appropriation of \$500,000,000 of Federal funds. Altogether approximately 10,000,000 persons were on the relief rolls in October, 1933, existing as best they could on a standard of living which in some cases rested on as little income as fifteen dollars a month, per family. Merely keeping vast numbers of Americans alive had become a major governmental duty.

#### THE CENTRALIZED PLANNING OF INDUSTRY AND AGRICULTURE

**Inefficiency of the Competitive System.** While individualistic businessmen were engaged in saving the competitive system as best they could by enlisting government aid in campaigns to stimulate buying and reemployment, engineers were beginning to wonder whether it was the most rational and efficient mode of operating the technological equipment of the country. Certainly it does function in a limited way but the engineer was appalled by the low level of its technical efficiency. Individual plants are built with little or no regard for the extent of similar facilities already in operation, so that capacity production seldom bears any close relation to actual demands. Cross-hauling looms up as a further source of waste; during the World War the Fuel Administration of the Federal Government generally ordered the delivery of coal to consumers from the nearest mine, saving 160,000,000 car-miles of haulage in a single trade. Again, the turning out of almost endless competing varieties

of lath, bricks, axes, or files, for instance, when but a few patterns or sizes would suffice, overloads dealers' shelves and interferes with orderly mass manufacture. The United States Chamber of Commerce itself has stated that fully a quarter of all effort in American factories is lost through lack of standardization alone. Consumers' money is thrown away in the purchase of worthless but highly profitable patent medicines or in buying goods made just to undersell rivals, which rust, warp, or otherwise fail almost as soon as they leave the store. The engineers' bill of indictment against the competitive system is a weighty one.

**The Calculations of Technocracy.** At last engineers began economic calculations. Suppose, they said, that all wasteful practices in the competitive system were suddenly eliminated by some process and an absolutely perfect centralized planning of industry was instituted. Next imagine that all plants were of the latest type, turning out the most durable articles in just the right volume to satisfy current demands, everyone being given an equitable share of the output. What would be the result? A number of engineers working at Columbia University, banded together in a group known as the "Technocrats," made statistical studies to answer this question. During 1933 they startled the nation, and indeed the world, with their figures. With modern labor-saving machinery in full running condition, production would be so high, they claimed, that only able-bodied adults between the ages of twenty-five and forty-five would actually need to be employed. Young and old could be released from toil at the machines. Furthermore persons in the prime of life who worked in the factories could enjoy a four-hour day and a four-day week. Although this schedule seems very restricted it was declared to be sufficient to produce enough to give every family in the country a high standard of living. Undoubtedly great are the potentialities of science and machinery!

**New York Chapter of Industrial Engineers Report.** According to the findings of a seven-year study of production



reported to the New York Chapter of Industrial Engineers late in 1933, there is an annual increase of productivity per man-hour in the better managed plants, while working time may be cut, without serious loss of efficiency, to between thirty and thirty-five hours per week, thus furnishing support for the advocates of the thirty-hour week. The increase of productivity is independent of business booms and depressions and points to the possibility of stabilizing trade on the level of a high general standard of living. This report, based on the data of twelve billion man-hours in every major industry all over the country, was begun under the auspices of the American Engineering Council, and may be taken to represent the positive results of an inquiry controlled by rigid scientific methods. Although it was not "dramatized" in the manner of the technocrats' findings, it pointed clearly in the same direction, so far as the productive capacity of technology is concerned, and indicated new lines of policy in industry.

**Growth of the Nation-Planning Movement.** During the early days of the depression that followed the stock-market crash of 1929, the general public showed little inclination to try bold experiments aimed at realizing the potentialities of science and machinery. As business grew worse, the average citizen, enlightened by personal experience and by the news of widespread distress, began to ponder on the irony of a situation which permitted millions of Americans to become destitute while the apparatus for providing abundance was ready to function at a moment's notice, provided the right key to action was discovered. Out of this meditation grew a number of remedial or curative suggestions for the establishment of government control over commercial competition. Meanwhile discontent increased until in the 1932 presidential election a majority of the voters were ready for a "New Deal," and they swept Franklin D. Roosevelt, its sponsor, into power. After taking the oath of office, he enlisted the services of a "Brain Trust" as the papers called

it, and it proceeded to help him enact into law pioneer proposals for a planned economy. In the midst of the initial trials of the new conception, trials which will throw light on the capacity of the modern citizen for directing a vast technological society rationally and efficiently, this volume is written. Since the fate of civilization, as we know it, depends upon the outcome, the national recovery legislation of 1933 deserves the close and impartial study of all technicians.

**Codes for Business.** National economic planning necessitates the integration of all the important branches of private economy into a purposeful whole. It is impossible to achieve this result where practically every individual concern remains substantially free to behave in its own willful fashion and usually without much, if any, regard for other concerns. Somehow each major trade must be formed into a unit coördinated with central programs of operation. To achieve this result, the National Recovery Act was passed in 1933, authorizing trade associations to draft codes controlling such matters as wages, hours of work, and unfair practices. Naturally these understandings were made exempt from the existing anti-trust laws. A group preparing a compact under the Act must be truly representative of its industry and must deal fairly with minor companies. When its tentative draft is ready, hearings are held to consider the same, at which consumers, labor groups, non-members of the organization, or affected parties in related lines present their views. The Federal Government participates in the proceedings by sending its own agents, one of whom serves as chairman. At the close of the discussion, and after possible revision, the code is submitted to the National Recovery Administrator who reviews it and in turn delivers it to the President of the United States. If the latter approves the agreement, it becomes binding on the whole trade. Where a business is unable to produce its own code, the President may write one for it. Codes and miscellaneous

agreements, once in effect, can be altered or canceled at the discretion of the President. In any case they expire in 1935, with the termination of the National Recovery Act, unless it is extended.

When industries began to take advantage of this legal procedure, many bitter disagreements disturbed private conferences called to formulate codes. It was soon apparent that a great deal of time would be required to put a majority of the nation's industries under a series of individual codes for separate trades. Seeking more immediate results, President Roosevelt quickly promulgated a blanket code, containing but a few general terms which were applicable to virtually all types of employers. A great country-wide campaign was started in July, 1933, to induce businessmen to agree voluntarily to abide by these simple restrictions, until the codes for their specialties were approved or until December 31st, 1933, at the latest. Motion pictures, newspaper articles, radio broadcasts, airplane flights, and mail canvasses were utilized to dramatize the effort. Ultimately thousands of concerns accepted the blanket code and were duly accorded the privilege of displaying a Blue Eagle emblem. Consumers, too, were mobilized by appeals for pledges to support stores showing the Blue Eagle. Before long Blue Eagles were found rather generally in windows over the United States. Meanwhile industries were at work preparing codes by the dozen. By the middle of September, 1933, codes had been approved by the President covering thirty businesses, hearings were scheduled on seventy more, while 200 were still in their initial stages.

Provisions are made in the National Recovery Act for compelling industries to live up to their respective codes. Any violation of a code by a company engaged in interstate or foreign commerce lays it open to prosecution in a Federal District Court. The penalties prescribed are \$500 for each day the offense continues and imprisonment for the officers responsible. Furthermore, the President has the power to



require business concerns to take out a Federal license in order to operate. Failure to do so, or non-compliance with the terms thereof, may involve punishment. At this writing, however, the task of approving codes has taken precedence over their enforcement, so that little in the way of police action can be reported.

**Agricultural Adjustment Act Agreements.** Handlers and processors of agricultural commodities, such as packers, are coördinated with the national economic plan through the medium of agreements prepared under the Agricultural Adjustment Act of 1933. Procedure resembles that of the National Recovery Act. The members of a given trade, operating in a specific area, draw up a joint covenant, which is submitted at a formal hearing for criticism. After suitable discussion and revision, it is sent to the Secretary of Agriculture whose approval must be given before it is effective. Once the compact is in force, concerns wishing to do business in the field covered by it must first secure a license for the purpose, said license being revocable by the Secretary of Agriculture. A series of marketing agreements have become law in this manner, the earliest one fixing milk prices for the dairy industry in the Chicago region. Furthermore the disciplinary cancellation of licenses has not only taken place but has been upheld in court.

**Organizing the Farmer.** On the whole, American farmers were very poorly organized in 1932. Provision had been made, it is true, under prior legislation, for official assistance to coöperative associations, but the latter had failed to master the situation. When 1933 brought visions of a national economic plan, therefore, radically different steps were seen to be necessary, if individual growers were to be coördinated with industry in one purposeful whole. The Agricultural Adjustment Act passed in 1933 authorized just such bold experiments. It empowered the Secretary of Agriculture to levy taxes on processing plants and to use the funds so obtained to subsidize raisers for reducing their

productive acreage. By entering into formal contracts with farmers, the United States Government hoped to draw them together, even though they had been unable to join hands among themselves.

**Restricting Production by Limiting Operating Time in Factories.** This sweeping economic legislation has enabled Federal administrative officers to apply strong pressure on the various rival interests in each trade, inducing them to deal more rationally with the problem of balancing production to consumption. For the moment, production should be restricted and consumption increased until they approximately equalize. The first half of the task, the reduction of output, can be performed in several ways. One method is to specify the maximum weekly running schedules for factories. For example, the cotton textile code forbids plants to operate with more than two forty-hour shifts per week. As a means of enforcing the proviso, mills are ordered to report periodically, to a central office in the Cotton Textile Institute, the amount of machinery in use as well as the actual number of hours during which it has been kept in motion.

**Setting Compulsory Production Quotas.** Much more difficult than the arbitrary limiting of factory operating time is the task of setting and enforcing compulsory quotas on total production. Indeed the complexity of the latter undertaking is so great that so far it has been resorted to only in extreme cases. Most striking of the present emergencies met in this fashion has been that resulting from haphazard drilling for oil. Overproduction of petroleum has often brought about very low prices, encouraging waste, wrecking companies, and despoiling future generations of their birthright. Under the old system of free competition it could hardly have been otherwise, for when rival outfits tapped the same formation, methods of oil removal were frequently employed which gave a large but rapidly diminishing flow, placing a premium on quick and feverish

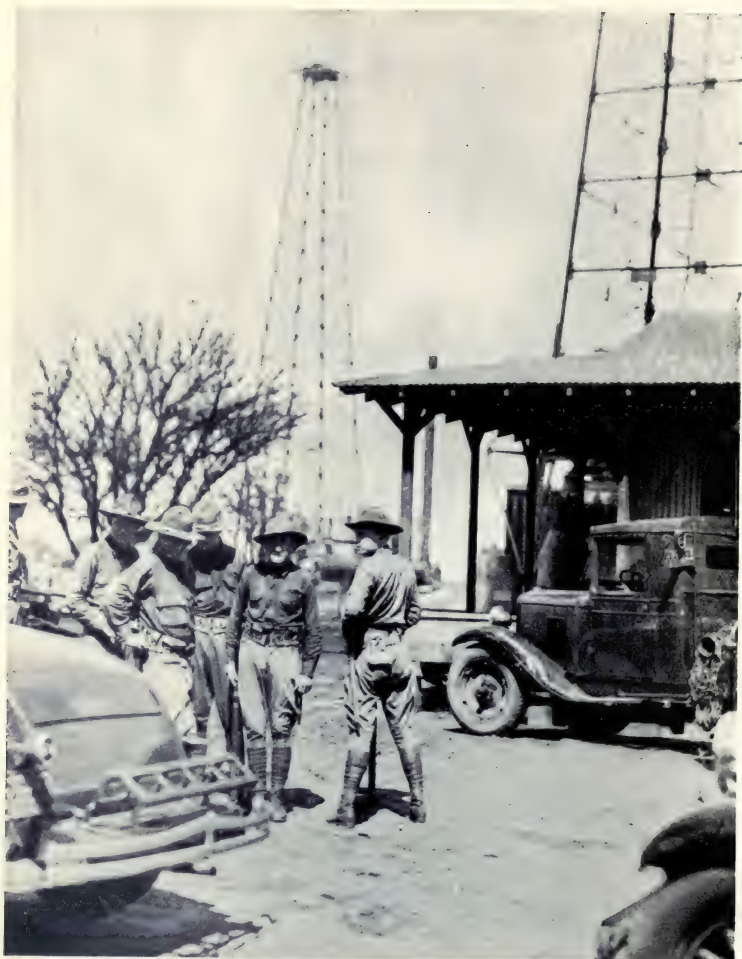


*Photograph by Wide World Photos, Inc.*

### STIRRING UP ENTHUSIASM FOR THE NRA

New York City's National Recovery Act booster parade of 1933 passes the reviewing stand.





*Photograph by Acme Newspictures, Inc.*

### GOVERNMENT CONTROL OF PRODUCTION

Members of the Oklahoma National Guard on duty in one of the oil-producing centers of the state, enforcing the Governor's command that private wells shut down (*see opposite page*).

activity at the start. Inevitably a mad scramble followed the discovery of each new deposit, forcing carloads of crude on a market that might be already glutted. Illustrative of the process is the history of the East Texas field, opened up with the coming in of a wildcat well on the 12th of November, 1930, yielding 1,295 barrels of oil per week. Outsiders quickly heard the news, arriving by the score to sink one additional pipe after another in rapid succession. By January, 1931, five wells were delivering 3,507 barrels a week; by March, thirty-four were delivering 392,259 barrels; by May, 389 were delivering 1,882,314 barrels; by July, 957 were delivering 2,463,699 barrels. Naturally such activities created an inordinate surplus, causing prices to fall precipitously. Starting at around a dollar a barrel they dropped in March to sixty cents, in June to thirty cents, in July to twelve cents, and ultimately to as little as two and a half cents a barrel.

After witnessing a series of such events, conservationists urged state governments to intervene and restrict production to reasonable levels. Under the resulting statutes, state boards are commonly vested with authority to control output from local wells, with a view to maintaining proper sales values. Typical of such arrangements is the Oklahoma act which forbids the removal of oil from the ground in amounts that will flood the market and keep prices unduly depressed. During the administration of Governor "Alfalfa Bill" Murray, the law became a dynamic factor in controlling Oklahoma's petroleum industry. Finding crude oil marketed at thirty cents a barrel, in 1931, and believing that a dollar a barrel represented a minimum fair price, Governor Murray ordered all wells (except stripper wells) to cease operations temporarily, until quotations rose to the desired figure. Next he called out the Oklahoma National Guard, which saw to it that his drastic command was applied with a will. A genuine shutdown was quickly experienced. When the legislation was challenged in the United States Supreme

Court, it was unanimously upheld, lending judicial approval to even such extreme forms of control. State quotas on oil production are apparently here to stay.

After the legal output of petroleum for a given state has been fixed, the proper governmental agency next "pro-rates" this total among hundreds of separate concerns. The initial step in the process is to assign quotas to individual fields, in proportion to their respective sizes and general character. Finally the minute task remains of setting extraction limits for the various wells composing each field, on the basis of their relative capacities. When it becomes necessary to alter the state schedules, everyone is supposed to receive the same consideration. That is, if Oklahoma decides to reduce by ten per cent the total number of barrels of oil to be removed from its deposits per month, each pool and each well must curtail its flowage by approximately ten per cent. From start to finish, the whole procedure is a highly orderly one.

Although fair enough on paper, state oil-production quotas were frequently ignored by a recalcitrant minority in practice. Well-owners found it easy, in certain circumstances, to remove oil from the ground in excess of governmental limitations, smuggling the same across the state border before it could be seized by local officers. Means of dealing with such evasions were finally provided through the passage of the National Recovery Act. Under that Act, the President of the United States issued an order, on July 11, 1933, forbidding the transportation of petroleum or its products in interstate or foreign commerce, after extraction had occurred in violation of state rules.

While the fixing of state production quotas, including enforcement with the help of Federal agents, was a step in the direction of effective control, it did not go far enough. Since each state continued to lay its plans with slight regard for those of its neighbors, any accurate balancing of extraction and consumption that might occur on a national scale



would have to be the result of pure accident. Seeking to substitute certainty for chance, a code for the petroleum industry was drawn up under the National Recovery Act that empowered the Federal Government to set a production quota for the entire nation, designed properly to meet current demands. Furthermore, it authorized the Federal Government to divide this total figure among the individual states, on a fair basis. In September, 1933, the new code went into operation, the Secretary of the Interior serving as chief administrator for the petroleum industry, with the assistance of a planning and coördinating committee of fifteen.

Effective September 15th, 1933, the legal maximum output of crude oil for the entire country was announced to be 2,049,700 barrels daily. This was allocated to various geographical districts as follows: Arkansas, 29,000 barrels; California, 480,000; Kansas, 112,000; Louisiana, 70,000; Texas, 975,200; Oklahoma, 540,000; New Mexico, 41,400; Rocky Mountain states, 38,900; Appalachian states, 94,200; Michigan, 30,000. State regulatory bodies are already accepting and applying these figures locally. Going into still greater detail, the new code permits the Federal Government to control the management of individual fields, by providing that freshly discovered deposits shall not be tapped extensively, except in accordance with a program duly approved by the President.

**Restricting Production with Government Subsidies.** Owing to the large number of comparatively unorganized farmers involved, the fixing and enforcement of compulsory limits on the production of agricultural commodities was not attempted at first. Recourse was had instead, by the Roosevelt administration, to a strictly voluntary system. First among the important groups to receive attention under the latter scheme were the cotton planters. During 1933, individual planters were invited to submit formal pledges to the Federal Government that they would, upon request,

plow under a certain proportion of their acreage of growing cotton. Those whose offers were selected for acceptance were officially notified. To make sure that they faithfully carried out the terms of the understanding, their premises were inspected before and after they had destroyed their share of the maturing crop. Land thus taken out of use did not necessarily lie fallow for it could be employed to raise vegetation to improve the soil, prevent erosion, or supply food for the home. Altogether approximately 10,300,000 acres of cotton were destroyed during 1933 in compliance with this program, or about a quarter of the total. This cut was intended to relieve the worst of the pressure on an already overcrowded market, burdened at the start with 12,000,000 bales left in storage from previous years.

Naturally some inducement had to be offered planters for destroying part of their cotton voluntarily. Actually, two alternative forms of subsidy were awarded to growers by the Roosevelt administration. Some farmers chose to rent the property they had taken out of cotton cultivation to the Federal Government, for a fee of from seven to twenty dollars an acre. Others preferred the optional plan of receiving a smaller income from leases, coupled with the speculative privilege of buying limited amounts of cotton from government warehouses at six cents per pound. Under the latter system, if the extensive crop reduction program should succeed in forcing prices to rise materially, those having purchasing rights might make an attractive profit.

Ingenious means were found to finance this program of aid without placing serious burdens on the national treasury. To reimburse itself for the \$110,000,000 spent in 1933 for ground rent, the Federal Government placed a tax on the processing of cotton into thread, cloth, or other articles. This levy was expected to serve a second purpose—bringing the prices of finished cotton up to a figure that was considered in Washington to be a fair quotation. Again, the Government suffered little from its willingness to dispose

of cotton at six cents a pound, as the cotton thus presented for sale was surplus stock, accumulated in years of abundance, that would have been forced on the market ultimately at bargain rates, in the absence of reduction arrangements. The unearned increment was to go to the growers responsible for it, instead of to the United States.

Similar methods are being employed to induce other groups of farmers to control production. In the case of wheat, immediate application of the new Agricultural Adjustment Act was not necessary, for severe droughts promised to cut the 1933 crop automatically below current domestic demands, forcing the consumption of part of the stocks left over from previous years. But protection against good seasons in the future was still deemed desirable. So growers have been asked to reduce voluntarily their wheat acreage by between fifteen and twenty per cent for 1934 and 1935. Processors must pay a tax of some thirty cents a bushel, a fee estimated to be sufficient to supply Federal authorities with \$150,000,000. These millions are to be used to pay farmers for abandoning 9,600,000 acres of wheat land, as well as to cover losses incurred in shipping limited surpluses to foreign countries, under government supervision. Analogous procedure is being followed with respect to tobacco, raisers willing to halve their output receiving cash bonuses made up from the income obtained from a processing tax on tobacco. As for hogs, a charge of half a cent a pound has been levied on the packing trade to raise money to finance Federal purchases of 4,000,000 pigs and 1,000,000 sows in 1933. The killing of so many young animals was intended to reduce the natural increase for 1934. Pork so secured was distributed by the Government for relief purposes among the unemployed. It looks as if the beginnings of order are emerging in agriculture—long one of the most chaotic of American occupations.

**Increasing Employment by Shortening Hours.** At the same time that it is making attempts to reduce production,



the Government is trying to increase consumption on a wide scale, so that supply and demand may be brought more nearly into balance. In beginning the task of raising the nation's purchasing power, the Roosevelt administration saw the desirability of placing as many of the unemployed as possible back on payrolls. To do this, some adjustment in working hours was absolutely essential. With the introduction of one new labor-saving device after another, the continuance of long hours had enabled a steadily smaller fraction of the total population to meet all current requirements for goods and services. To check this trend, it was necessary to cut the duration of the average shift by a corresponding amount, so that work once performed by a few on a long week would now be shared by many operating on a short week. Compulsory means of achieving this result, to some extent, were available through the industrial code system provided by the National Recovery Act.

Translation of theory into practice was beset by difficulties, however. Employers were naturally anxious to avoid burdening themselves with the heavy costs of extra shifts, while labor saw in the shorter-hour movement a chance for an indefinite improvement of its lot. The maximum hours fixed in the various codes approved by the President, therefore, represent a compromise between the points of view of capital and labor. For example, a representative of the United Textile Workers of America urged a 35-hour week for the cotton mills, claiming that only by such a drastic reduction from the existing 50-hour week could the 100,000 textile workers then out of work be re-employed. As ultimately adopted, the cotton code set 40 hours per week as the maximum. Out of such turmoil important results emerged. Through the general tendency to cut hours of work, a marked rise in employment was realized.

**Minimum Wage Regulations.** If shorter hours were accompanied by corresponding decreases in individual wages, the mere reëmployment of millions of men and women would

fail to produce the desired impetus to consumption through increased buying power. To assure positive growth in purchasing power, definite increases in hourly wage-scales must be made. Recognizing this fact, the Federal Government, earnestly besought by labor leaders, urged industrialists and merchants to adopt codes fixing minimum rates of pay considerably in excess of previous standards. Employers, on the other hand, were conservative about altering wage-scales, naturally fearing financial losses. Recently approved codes, therefore, represent a compromise between the hopes of the Government and of labor and the reluctance of private interests to make a change. For example, labor leaders urged the fixing of a minimum wage of \$14 a week for textile workers, as an improvement over scales as low as \$6 a week then being paid. Employers countered with a proposal for a \$10 week, ultimately agreeing to \$12 a week in the code as finally signed by the President.

Despite the heated arguments that occurred over the proper figure for minimum wages, the general trend was toward an increase. Unfortunately statistics are not available at this writing which will afford accurate quantitative data on the rise in payrolls for the entire country, due to wage adjustments alone, but one important indication is at hand. Wages have apparently been lifted to such a high level that it is often unprofitable to hire children for industry. For this reason, it has become an easy task to forbid the employment of persons under sixteen years of age by inserting an express clause to that effect in the average code, the cotton textile industry starting the practice. It is estimated that a total of between 250,000 and 300,000 child laborers will be replaced by adults in this manner.

**Price Control.** Inevitably industry will try to shift to the consumer part of the expense of taking on additional workers and increasing wage-scales. Two dangerous results are then possible. If ruthless competition prevents trades from earning enough to pay their employees properly,

wholesale bankruptcies will follow. On the other hand if business shoots the cost of living upwards faster than national purchasing power can grow, production will outrun demand, and national economic planning will suffer an equally severe set-back. Faced with this dilemma, Federal and state governments have given careful attention to the possibilities of controlling both maximum and minimum prices with a view to protecting their recovery programs. Simplest of all their expedients for regulating prices is that of arming consumers with knowledge to help them fight their own battles. A case in point is the Federal policy of issuing periodic statements of fair prices for important commodities, trusting that buyers will somehow develop a technique for holding prices at such levels. Occasionally Federal officers resort to more positive action, backing up demands with legal threats. A group of Iowa bakers, for example, was reported to be on the verge of raising bread prices three cents a loaf, to anticipate higher prices for wheat, in turn made necessary by the processing tax imposed under the Agricultural Adjustment Act. Upon hearing of their project, Secretary of Agriculture Wallace wrote to them condemning their proposal and threatening to apply the anti-trust law, among other things, if the drastic rise was made. In reply, the bakers announced that the change would not occur.

Federal and state authorities may even go so far as to fix prices and compel private parties to observe the same. Initial experiments along this line began in the public-utility field, where official bodies have for years controlled the rates to be charged for gas, water, electric, telephone, and transportation services. During 1933 similar principles were applied to the dairy industry, milk prices being determined and enforced by New York and other states. California approved a state code for barbers in the same year, announcing obligatory prices for haircuts. Under the national automobile code, dealers may neither sell new cars below cost, nor unduly raise prices above the level prevailing in July,



1933. The steel, coal, lumber, and cotton codes expressly provide for the fixing of minimum prices. As a last resort, the Federal oil administrator can set the minimum price of oil for the entire United States.

**Currency and Price Fixing.** Since the volume and nature of the money used in the exchange of commodities affect the prices of commodities, control over currency and banking enters into the new Federal planning projects (above, Chapter IX). If prices fluctuate violently, manufacturers and merchants cannot make sure calculations ahead and the whole program of stabilization is thus jeopardized. Now, economists are agreed that there is some relation between the volume of the currency and prices; at all events they are agreed that an extensive inflation or increase in the volume of paper money will raise prices; but they are unable to determine the precise relation of volume to price increases or declines. Amid many uncertainties, however, Congress conferred upon the President immense powers over the coinage of gold and silver and the issue of paper money; and the President, after he received these powers, announced his intention to restore prices to about their 1926 level and hold them at that point, by currency manipulation. Whether this purpose could be realized by the methods employed has been and long will be a subject for heated debate among economists; and, since they are dealing with an inexact science, full of surmises, traditions, and incalculable variables, they appear to be hopelessly divided over the precise effects of any specific action in the monetary field. Yet it is evident that price stabilization must accompany planning if the latter is to be efficient in operation.

#### HOUSING, HEALTH, AND LIVING CONDITIONS

**New Housing Legislation.** As a part of the program for stimulating industry and employment, the National Industrial Recovery Act provides for the following types of official housing activity: the "construction, reconstruction,

alteration, or repair under public regulation and control of low cost housing and slum clearance projects." To supervise the allotment of Federal funds for these ends, a Housing Division was created in the Public Works Administration. With a view to meeting the Federal Government half way, several states—Arkansas, California, Delaware, Florida, Illinois, Kansas, Massachusetts, New Jersey, New York, North Carolina, South Carolina, and Texas, for example—have enacted laws creating regulatory bodies to coöperate with the Public Works Administration. The instrument provided for action is generally the limited-dividend corporation, a private organization limited as to possible profits; but going beyond this idea, Ohio authorized the establishment of county housing authorities—"special municipal corporations formed on the analogy of a Port or Bridge Authority, to undertake the construction of low-cost housing." Although these are small and tentative beginnings, they recognize the fact that great construction work remains to be done in this field.

There is no doubt about the need, or the capacity of engineering to meet it. Stuart Chase presents the case as follows:

"At a conservative estimate, two thirds of all American families are inadequately, if not indecently, housed according to the researches of Edith Elmer Wood and others. The condition obtains in the slums and cubicle apartments of great cities, in the waste places of suburbia, in the shacks and shanties of the coal towns, in the leaky, cold, unplumbed farmhouses of the great open spaces, in the whitewashed cabins of Southern share-croppers, in the desolate hovels of the hill-billies. The editors of *Fortune* declare in *Housing America*: Authoritative estimates put something up to 90 per cent of farmhouses, 80 per cent of village homes, and 35 per cent of town homes beyond the pale for lack of a sanitary toilet within the house, and almost as many for lack of running water. To these inadequate homes must be added homes inadequate for lack of light and air (say a third of the homes in the greater cities), homes inadequate for reasons of

overcrowding, toilets in common, dampness, etc. The total most certainly exceeds half the homes of the country.

"If to this we add homes without bathrooms and central heat—certainly necessities in any really adequate standard—the ratio of subnormal housing jumps to at least two thirds of all. This means that of 30 million families, 20 million need new homes, or extensive capital improvements in old homes.

"To put 80 million people into decent, tight, heated houses or apartments, with electric lights and running water, quarters otherwise however modest, would place a burden on lumber mills, brickyards, cement factories, glass works, paint shops and railroads which they have never met; which is far beyond the capacity of most of these industries, save over a long period."

**Sanitation and Public Health.** In planning construction work calculated to give extensive employment, the Public Works Administration gave preference to water-works, sewers, and sewage disposal projects, to be undertaken by local governments or private corporations under governmental control. As in the case of housing a number of states passed special legislation authorizing local bodies to accept Federal aid and to coöperate with Federal authorities. From what has been said about the primitive sanitary condition of American homes, it is clear that there is room for indefinite engineering expansion in this field—an expansion designed to bring the worst sections up to the standards set in model centers. Since a large part of the ill health in the country is due to lack of proper sanitation, such work could strongly supplement long standing efforts to improve public health (above, pp. 399, 467). Besides serving the nation, it would give employment to many engineers whose talents go to waste for lack of opportunity. Although the Recovery Act makes no direct provision for expanding health services, there is need in this field as well as that of prevention. According to the Committee on the Costs of Medical Care, physicians in general are employed between one-third and one-half of their time, one-third of the hospital beds are



unoccupied one-third of the time, thousands of trained nurses are unemployed, and thousands of people suffer from want of medical attention. If existing facilities were fully utilized, there would still be need for expansion, as indicated by the following table prepared by the Committee:

	<i>Actual Number in 1930</i>	<i>Number Needed to Provide Full Service for All Americans</i>
Physicians.....	144,000	174,000
Dentists.....	68,000	219,000
Nurses—visiting.....	19,000	54,000
Nurses—hospital and home.....	118,000	216,000
Hospital beds.....	956,000	1,422,000

**Living Conditions.** Looking beyond the relief of misery by doles, either in poorhouses or outside, the Recovery Act provides an appropriation of \$25,000,000 “for aiding in the redistribution of overbalanced population in industrial centers.” In this connection a notable experiment has been undertaken in West Virginia where two hundred families dependent on unemployed miners are to be settled on the land, housed in modest homes, provided with subsistence garden plots. States have authorized similar enterprises. Oregon has provided for a survey of certain waste lands, the classification of these lands for utilization, the creation of improvement districts, and the use of relief funds for development purposes. The legislature of Pennsylvania has given legal sanction for the formation of agricultural associations empowered to buy land, erect and maintain buildings, and lease holdings at a low rental to unemployed families. These and other experiments indicate a public resolve to find ways and means for creating decent living conditions for thousands of citizens on the margin of subsistence, willing and able to work, yet they avoid the demoralizing effects of charity, doles, and idleness. In the process waste lands may be redeemed and dignified homesteads erected. Constructive work is to be substituted for the loafing and wandering which degrade men and women into unemployable public charges.

## THE OUTLOOK

**Effects of National Planning on State and Local Governments.** In the processes of planning and control, judging by tendencies so far revealed, the relations of the Federal Government and state and local governments are to be vitally altered. The former is now carrying on immense operations of its own in efforts to increase employment—the Tennessee Valley development, the Conservation Corps, the experiment in community building in connection with efforts to redress the balance between urban and rural regions, and other public-works enterprises. At the same time it is granting money to states, cities, counties, towns, and villages, and even to local housing corporations, for the purpose of enabling them to engage in public-works employment undertakings. It is assuming ever larger responsibilities in the matter of relieving the unemployed through broad public grants; in other words, it is taking over functions of government once deemed purely state and local in character; and as local institutions break down under the load of taxes and unemployment the Federal Government practically takes them over. If this continues long and spreads, the historic system of territorial and jurisdictional divisions, described in the books on political science, will certainly be profoundly changed, if not discarded entirely. Finally, through the various industrial codes (above, pp. 535–537), the Federal Government, in fact if not in theory, goes far beyond control over interstate and foreign commerce and reaches down into industries once supposed to be completely under state jurisdiction. Should this be developed into a system, the jurisdictional law books of political science will become as obsolete as the Ptolemaic system of astronomy. It is scarcely too much to say, then, that under the drive of technology, and the economic adjustments to cope with its march, the historic formulas of political science and the subdivisions of the subject will have to be recast in the near future.

**Future of National Planning.** National economic planning is concerned with maintaining a delicate balance between numerous perplexing variables. In order that agricultural production may closely approximate demand, allowances must be made for changes in the weather. To absorb all the unemployed in industry, and give everyone money with which to enjoy a reasonable standard of living, hours must be reduced and pay increased by precisely the right amount. As the cost of such a course forces prices upward, they must be halted at an optimum point or the expected relief will not materialize. It is a very difficult task to perform these calculations accurately because America has never attempted the feat before, in time of peace. Furthermore, the National Recovery Administration and the Agricultural Adjustment Administration were so hastily created that they are naturally loosely organized. Both the development of proper statistical technique and the efficient set-up of executive agencies will take months, perhaps years, of earnest effort.

If the patience of private parties is exhausted too rapidly, the program may be readily defeated before it is fairly started. So vast is its extent and so numerous its details that enforcement is difficult at best. It has been an easy thing for opponents of the Recovery Act to violate codes, lengthen hours, cut pay, and otherwise force companies that are honestly supporting the Federal Administration to adopt a similar course in self-defense. No staff of inspectors headquartered at Washington can possibly cope with widespread evasion of this type. Similarly the attitude of labor is vital, for through repeated strikes it can slow down the wheels of industry and upset nicely balanced plans on paper.

In other words, the outcome of any effort to plan, adjust, and control industries and the several branches of agriculture along the lines laid down by Federal and state measures in 1933 must depend upon the capacity of millions of individuals to coöperate and restrain their natural propensity for taking advantage of every opportunity to enrich



themselves in a scramble. Moreover, most of these special measures are designated as temporary. Unless terminated earlier or extended, the National Recovery Act and the Agricultural Adjustment Act automatically expire in 1935. The future of great technological enterprises is, therefore, undetermined. But the challenge of the new age to engineers is still open, and will long remain open. It is to be hoped that the rising generation of engineers will face that challenge boldly and apply the indispensable instruments of their science—rationality and efficiency—to both government and industry. If they do not bring broad and open minds to the consideration of the social results of their work, Technology may become a Frankenstein. If they live up to the obligations of their science, the beneficial services of Technology may be preserved and extended beyond all dreams of the early engineering age.



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## INDEX

- Abandonment, of services by utilities, 424-425
- Accounting, governmental, need for, 264; comptrollers, 265-268; rationality in, 289; control of utility accounts, 436
- Administration, growth in size of, 8-9; reorganization, 9-10; executive rule-making, 100-103; administrative tribunals, 103-105; growth in presidential power, 107-109; executive rule-making, 111-112, 117-118; reports to legislators, 141-143; investigation of administration by legislators, 144-145; executive rule-making, 156-162; executive compared with judicial law enforcement, 164-165; administrative tribunals, 193-194; size of administrative organization, 213-214; technicians, 215-216; line organization, 216-217; boards, 217-219; staffs, 219-220; field units, 220-222; coördination, 222-224; growth of executive agencies, 224-227; reorganization, 227-233; appointments, 233-239; removal, 239-241; turnover, 241-242; employee unions, 242-243; classification, 243-244; promotion, 244-246; training for, 246; retirement, 246-247; corruption, 247-248; public and private service compared, 248-250; ideal system of, 250-254; districts, 254-256; compared with judiciary, 256-257. *See also* President
- Aëronautics, *see* Aviation
- Agreements, international, 31-32; agricultural, under AAA, 537
- Agriculture, crop reduction bonus, 280; irrigation and, 379-381; research in, 415, 416-417; AAA and, 537-538, 541-543; subsistence farms, 550
- Airports, municipally owned, 5, 364
- Airways, 393-395
- Alaska, government of, 22-23; railroad in, 363
- Ambassadors, 27
- Ambulances, government, 408
- Annexation, of cities, 46-48
- Anti-trust laws, 4; and patent combines, 455-456; and monopolies, 524-527; and NRA, 535
- Appointment, of government officers, 97-98, 233-239
- Arbitration, commercial, 194-195
- Armaments, trade in, 326-327; embargoes on, 327-328; race in, 329; limitation of naval, 330-334; limitation of land, 334-335
- Army, for riot duty, 198-199; staff of, 219-220; district organization of, 220-221; civilian control of, 336-337; volunteer basis of, 337; regulars, 337; reserves, 338-339, 339-340; mobilizing, 343-344
- Assessments, special, 294-295; of property for taxation, 298
- Attorneys, 185-186, 187-192; patent, 452-453
- Audit, government, need for, 264; comptrollers and auditors, 265-268
- Aviation, subsidies to, 2; aids to navigation, 2; municipal fields, 5; agreement with Canada, 32; uniform state law on, 41-42; rule-making for, 100, 157-158, 160-161; subsidies, 282-283; municipal

- fields, 364; airways, 393-395; research in, 414-417; as a public utility, 422; safety rules for, 479-480
- Ballots, fraud and, 79-81
- Bench-marks, Federal, 411
- Bidding, on supplies, 271; on public works, 273-275
- Bimetallism, 315-317
- Birth control, 498-500
- Boards, *see* Commissions
- Bonds, government, 305-308
- Bonus, to veterans, 278-281
- Borough, nature of, 20; in New York City, 48-49
- Boundaries, political, technology cuts across, 10-11; haphazard, 24-25; effect on engineering, 25-26
- Bridges, local coöperation in building, 44-45; government toll, 363-364
- Budgets, need for, 259; nature of, 259-260; preparation of, 260; defects in, 262-264; rationality and, 288-289
- Buildings, codes for, 473-475; permits, 475; zoning permits, 509-510; architectural control of, 515
- Buses, government ownership of, 363, 385-386; as public utilities, 421
- Business, government in, 5; income from government businesses, 300-302; debt limits and government ownership, 304-305; how government gets into business, 357-363; government businesses described, 363-381; results of government operation, 381-385; public ownership of utilities, 444; anti-trust laws, 522-527; national recovery legislation, 532-547
- Cabinets, 231-232
- Cables, landing licenses for, 34; government control in World War, 352
- Canals, Cape Cod, 283; government construction of, 358; Panama, 366; as aids to shipping, 388-389
- Carnegie, Andrew, 303
- Censorship, of press, 486-487; of movies, 487-489; of radio, 489-491
- Census, 413
- Centralization, of governmental powers, 52-57, 284, 551
- Certificate of public convenience and necessity, 423-424
- Charters, 111, 129-130
- Chicago, sewage problems of, 35-36, 401
- Cities, 20; coöperation between, 44-45; extra-territorial rights, 45-46; annexation, 46-48; consolidation, 48-49; interstate relations and, 50-51; separation of powers in, 96; commission government for, 99; charters, 111; city council, 121, 128; charters, 129-130; courts, 180; chief executives in, 211-213; auditing of accounts, 266-267; state aid to, 284, 302; utility regulation by, 439; health work of, 467, 469; building codes, 473-475; city planning, 503-517; balance with rural areas, 518-519
- City managers, training of, 213
- City planning, need for, 503-505; movement for, 505-506; zoning, 506-510; street plans, 510-511; control of real estate subdivisions, 511-512; transit facilities, 512-513; parks, 513; public buildings, 514; architectural control, 515; slums, 515-516; future cities, 516-517
- Civic center, in city plan, 514
- Civil cases, in law, 166-167, 168, 176-177
- Civil service, 5-6, 236-239, 240-241, 243-247, 249
- Classification, of government posts, 243-244

- Coal, 422
- Coast Guard, 406-407
- Codes, building, 473-475
- Codes, industrial, 3-4, 535-537, 538; shorter hours and, 544; wages and, 545
- Codification of laws, 162-163
- Commissions, commission government for cities, 99; as rule-makers, 156-157; nature of, 217-219, 226, 231; utility, 439-442
- Committees, legislative, nature of, 123-125; hearings, 124; conference, 125; of city councils, 128; joint, 128; specialization by, 139-141; lobbies and, 150-151
- Common carriers, defined, 420-421
- Common law, 175-176
- Compacts, interstate, 37-39
- Comptrollers, 265-268
- Condemnation, excess, 303; by public utilities, 419-420
- Congress, and separation of powers, 96, 98; composition of, 121-122; work of, 123-126; sessions of, 132-134; lost motion in, 134-138; information for, 138-146; pressures in, 146-156
- Conscription, military, 344
- Consolidation, of cities, 48-49; city and county, 49
- Constables, 187
- Constitutions, Federal, 19, 52, 110-111; state, 111; control statute-making, 113-117; conventions to amend, 128-129; hard to revise, 130-131; validity of tax law and, 169-170
- Consuls, 27
- Contracts, government, 6, 271, 272-275; rationality and, 290
- Convention, party, 66-67; constitutional, 128-129
- Coöperation, voluntary local, 44-45; compulsory local, 45
- Coördination, in administration, 222-224
- Copyrights, interpretation of copy-right act, 170-172; issuance of, 461-462
- Coroner, 187
- Corporations, public, and political boundaries, 61-62
- Corruption, in legislative bodies, 152-153; in law enforcement, 202-203; in administration, 247-248; in contracts, 272-273
- Cotton, reduction program for, 541-543
- Council, city, 97, 121, 128, 132
- Counties, nature of, 20; city-county consolidation, 49; county boards, 99-100; charters, 130; county planning, 517
- Courts, in interstate disputes, 35-37; uniform state decisions, 43; administrative bodies similar to, 103-105; cases before, 164-178; Federal, 178-180; state and local, 180-181; special, 181-182; complexity of, 183; procedure in, 183-190; appeals, 190-193; and technology, 203-210; compared with executive tribunals, 256-257; in utility cases, 441-442; in patent cases, 449-450, 451-453; in workmen's compensation cases, 480; in zoning cases, 510; and anti-trust laws, 525
- Crime, new instruments of, 195-197
- Criminal law, 167-168, 176-177
- Currency, Federal control over, 310; types of money, 310; inflation, 311-312; metallic money, 312-319; reconstruction of, 531, 547
- Debts, public, importance of, 304; debt limits, 304-305; bonds, 305-308
- Democracy, and state's rights, 56-57; as basis of government, 63-64; parties, 64-66; election and recall of officers, 66-69; referenda, 69-72; initiative, 72-74; examples of measures up for popular vote, 74-76; the suffrage, 77-79; bal-



- lots, 79-81; criticism of popular control, 81-90; reforms, 90-95
- Detroit, Mich., expansion of functions of city government, 8-9
- Dictatorship, 82-83
- Diplomatic agents, 27-28
- Direct primary, 67
- Disease, *see* Health, public
- District, special, *see* Special districts
- Districts, for field administration, 59, 220-222, 254-256
- Doctors, regulation of, 472; social medicine and, 483-484, 549-550
- Documents, public, how to obtain, 417-418
- Draft, for war, 344
- Drugs, addiction, 471; fake cures regulated, 471-472
- Economic planning, need for, 532-534; industrial codes, 535-537; agriculture and, 537-538; restriction of output, 538-543; shorter hours, 543-544; minimum wages, 544-545; price control, 545-547; outlook for, 551
- Education, control of opinion in war, 346; control of opinion in the schools, 491-492
- Efficiency, public utility, and rates, 430-431
- Elections, nominating, 66-67; general, 67-68; recall, 68-69; referendum, 69-72; initiative, 72-74; examples of, 74-76; non-voting, 78-79; frauds, 79-81; value of elections, 81-86; campaigns, 86-91; experts and, 91-93; money in, 93, 152; of legislators, 123; for administrative officers, 233-234, 239; popular approval of bond issues, 305
- Electric light and power, government plants, 5; Niagara Falls power treaty, 31; Hoover Dam compact, 38; initiative measure concerning, 74; propaganda for private, 88-89; interstate trans-
- mission case, 116; executive report on, 141-142; influence on legislation, 149-151; rule-making for, 158-159; court case on interstate transmission, 168-170; taxes on, 292; Muscle Shoals, 357, 360; Hoover Dam, 360; government ownership, 361-362, 370-372, 382, 385; emergency power from aircraft carrier, 410; as a public utility, 421-422. *See also* Chapter XIII for rate and service regulation procedure, applicable to all utilities
- Embargo, arms, 327-328
- Eminent domain, right of, used by utilities, 419-420
- Employment, for engineers, *see* Civil service; for the emergency relief program, *see* Unemployment
- England, absence of constitution in, 116-117
- Equity, in law, 176
- Erie Canal, 72, 85-86, 358, 389
- Evolution, teaching of forbidden, 491-492
- Excess condemnation, 303
- Expert, general problem of, 11-12; and democracy, 84-86; and legislative bodies, 92; and elective officers, 92-93; and rule-making, 101-102; and administrative tribunals, 104; dangers in dominance of, 105-106; in legislative bodies, 138-146; and rule-making, 159; in utility regulation, 443-444
- Express, parcel-post competition with, 367
- Extradition, 203
- Extra-territorial activities, 45-46
- Factories, government, 360-361, 362-363, 372-375; safety rules for, 475-476
- Federal aid, for highways, 39; for flood control, 39-40
- Federal government, powers of, 19; Federal aid, 39-40; separation of

- powers in, 96, 98, 103-104, 107-109; Congress, 121-122, 123-126, 132-134, 134-138, 138-146, 146-156; courts, 178-180, 182; administration, 211, 212, 215-217, 218-224, 228-229; subsidies, 276-287; control of currency, 309-319; war powers of, 320-355; business enterprises, 363, 364-366, 366-368, 371, 374-376, 378-381; free services, 387-391, 393-395, 397-398, 406-408, 411-418; utility regulation, 439; patents and copyrights issued by, 445-462; health and safety, 466-467, 470-471, 476-477, 479-480; censorship, 486-487, 489-491; birth control, 499; anti-trust laws, 522-527; temporary relief measures, 529-532; economic planning, 535-553
- Federalism, Swiss, 57-58
- Ferries, municipal, 365
- Filibustering, 135
- Finance, Federal aid to states, 39-40; budgets and accounting, 259-268; supplies and contracts, 268-276; subsidies, 276-288; outline of finance principles, 288-290; taxation, 291-300; miscellaneous sources of revenue, 300-304; public debt, 304-309; currency system, 309-319; war finance, 352; public-works costs, 530; agricultural subsidies, 541-543
- Fines, as revenue, 303-304
- Fire, damage by, 402-403; fighting of, 403-405; salvage, 405-406; rescue work, 406; prevention of, by building codes, 474-475
- Flood control, Mississippi, 39-40; special districts for, 50; special assessments for, 294-295; control plans, 395-399
- Food, handlers regulated, 467-468; and drug laws, 469-471, 483
- Foreign affairs, isolation, 26-27; diplomatic and consular agents, 27-28; treaties, 28; agreements, 31; international government, 32; retaliation, 34; relation of war to, 320-322, 324-328, 329-336; World War, 343-355
- Forests, government, 5, 359-360, 375-378; difficulties with private management, 358-359
- Franchises, 423
- Frauds, ballot, 79-81
- Garbage, interstate dispute over, 36-37; disposal of, 402
- Gas plants, government, 5, 372, 385; regulation of as utilities, 421-422, 426-428
- Geneva, naval conference at (1927), 332
- Germany, inflation in, 312
- Gerrymandering, 123
- Gifts, as government revenue, 303
- Gilds, 492
- Gold, as money, 312-315; bimetalism and, 315-317
- Governor, and separation of powers, 96, 97; veto by, 125-127; calls special sessions, 133, 211; selection of, 212; training of, 212; and budgets, 261; heads militia, 337
- Great Lakes, level dispute, 36
- Guam, government of, 23
- Harbors, New York compact, 37; government-owned, 366; improvement of, 388; in city plan, 513
- Hawaii, government of, 22-23
- Health, public, medical progress, 463-464; vaccination, 464-465; quarantines, 465-467; sanitary regulations, 467-468; occupational disease, 468-469; smoke and noise, 469; food regulation, 469-471; narcotics, 471; regulation of cures, 471-472; results of health work, 472-473; problems of legislation and enforcement, 482-483; social medicine, 483-484; recovery program and, 549-550

- Heating systems, government-owned, 372
- Highways, 2, Federal aid for, 39, 58; Federal and state aid for, 302-303, 391-393; research work on, 414; city streets, 505, 510-512
- Holding company, and utility regulation, 436-438
- Hoover Dam, compact for, 38; power at, 371
- Hospitals, public, 408, 467
- Housing, slum problem, 515-516; under recovery program, 547-549
- Ice, government manufacture of, 372-373, 386
- Icebergs, patrol for, 33, 391
- Impeachment, 239-240
- Income tax, 296
- Industry, codes for, 3-4, 535-537; restriction of production, 538-541
- Inflation, 311-312
- Infringement, patent, 452
- Inheritance tax, 296
- Initiative, the, 72-76; and charters, 129
- Injunction, bill of, 172-174
- Inspection, of supplies, 269-270; of public works, 275-276
- Insurance, workmen's compensation, 482; war risk, 344
- Interference, in patent law, 448-449
- International Health Office, 33
- International ice patrol, 33
- International Joint Commission, U. S. and Canada, 32-33
- Interstate affairs, 34-43
- Interstate Commerce Commission, 439
- Irrigation, government works for, 5, 379-381
- Isolation, American, 26-27
- Judges, 183-184, 188-191
- Judiciary, and separation of powers, 96, 98. *See also* Courts
- Jury, 184-185, 188-190
- Kellogg peace pact, 325-326
- Laissez faire*, 522-523, 524, 527, 529
- Land, public, grants to railroads, 1, 281; leasing of mineral land, 378-379
- Laws, uniform state, 40-43
- League of Nations, 33-34, 325
- Legislature, state, and separation of powers, 96-98; compared with administrative rule-makers, 100-103, 104-105, 107-109, 121-122; work of, 123-126; sessions of, 132-134; lost motion in, 134-138; information for, 138-146; pressures on, 146-156; passage of budget by, 262
- Liberty, personal, *see* Personal liberty
- Libraries, legislative reference, 145-146; Library of Congress, 418, 461
- Licenses, for technicians, 492-496
- Lighthouses, district organization for, 220, 390
- Line organization, 216-217
- Loans, to shipping, 284-285; for recovery, 286-287; short-term, 308-309; Federal, 530-531
- Lobbies, 146-156; definition of lobbyist, 154; registration of, 154; influence on rule-making, 160-162
- Log-rolling, 155
- London conference for naval limitation, 332-333
- Mail, interdepartmental board on, 223; excess payments for carrying, 282-283; post office operations, 367-368
- Mandamus, writ of, 174-175
- Mapping, 3; coast charts, 391; topographic, 411-412; geologic, 412; coast charts, 412; aviation, 412; soil, 412
- Marines, 337-338
- Marshal, court officer, 186-187
- Match industry, poisonous, destroyed by taxation, 293, 469
- Mayor, separation of powers, 97, 99; veto by, 128; as chief execu-



- tive, 211; selection of, 212; and budgets, 261
- Merit system, 236-238; removal under, 240-241
- Military training, compulsory, 337
- Militia, in riots, 198-199; civilian control of, 337; volunteer basis of, 337; organization of, 338; reserves, 339; mobilizing of, 343
- Milk, government pasteurizing of, 374
- Mills, government, 374
- Minerals, lease of government, 378-379
- Mines, rescue work in, 407-408
- Mississippi, flood control on, 39-40, 395-398, 408-410
- Mobilization, preparation for industrial, 340-341; of troops, 343-344; of industry, 344-346
- Money, *see* Currency
- Monopolies, *see* Public utilities, Patents, and Anti-trust laws
- Motion pictures, censorship of, 487-489
- Motor vehicles, varied state laws on, 40-41; taxes on, 292; gasoline tax, 294; safety rules for, 478-479
- Municipal ownership, *see* Business
- Muscle Shoals, 357, 371
- Narcotics, 471
- National Conference of Commissioners on Uniform State Laws, 41-42
- National defense, 335-336. *See also* War
- National planning, 3-5; and political boundaries, 61; and the currency, 318-319; need for, 532-534; codes for industry, 535-537; agriculture, 537-538; controlled production, 538-543; shorter hours, 543; minimum wages, 544-545; prices, 545-547; housing, 547-549; health and sanitation, 549-550; subsistence farms, 550; outlook for, 551-553
- Navy, limitation of at Washington Conference, 330-332; Geneva Conference, 332; London Conference, 332-333; America approaching treaty limits, 333-334; future limitation, 334; civilian control, 336-337; volunteer basis, 337; regular force, 337; reserves, 339; mobilizing, 343-344
- New York, harbor compact for, 37; consolidation of, 48-49; regional plans for, 518
- Niagara Falls, power treaty for, 31; regional planning about, 517
- Noise, control of, 469
- Nomination for office, 66-67
- Occupational diseases, 468-469, 481
- Occupational restrictions, 492-496
- Opinion, liberty of, 486-492
- Ordinances, nature of city, 111
- Original cost, as rate base, 431-433
- Panama Canal, zone government, 23; treaties concerning, 29-30; engineering features of, 31; as a business, 358, 366; disease control, 417
- Pan-American Sanitary Bureau, 33
- Parks, in city plan, 513
- Parole, 202
- Parties, organization in legislative bodies, 155-156
- Patent Office, 447-452
- Patents, special court for, 182; purpose of, 445; how to obtain, 446-450; pending, 450; transfer of, 450-451; foreign, 451; validity of, 451-452; infringement, 452; attorneys, 452-453; combines, 453-456; social control of, 456-461
- Penalties, as source of revenue, 303-304
- Personal liberty, relation to technology, 485-486; liberty of opinion essential, 486; freedom of press, 486-487; movie censors, 487-489; radio censorship, 489-

- 491; opinion in schools, 491-492; occupational restrictions, 492-496; Sunday blue laws, 496-498; birth control, 498-500; liquor, 500; other restraints, 501.
- Petroleum industry, patent pool in, 454, 456; quotas on production, 538-541
- Philippines, government of, 22-23
- Pipe lines, as utilities, 421
- Planning, in government, 502-503; city, 503-517; regional, 517-519; state, 519; growth in, 520; national, 532-553
- Police, Federal, 197; local, 197-198; state, 198; troops as, 198-199; private, 199-200; technical facilities of, 200-201
- Pork-barrel, 155
- Port of New York Authority, 37, 517-518
- Possessions, American, nature of, 21-23
- Post office, mail subsidies, 282-283, 366-368, 383
- Powers, separation of, 96-109
- President, and foreign affairs, 28; signs treaties, 29; and separation of powers, 96, 98; veto by, 125-126; as chief executive, 211; selection of, 212; training of, 212; and the budget, 261-262; as head of armed forces, 336
- Press, freedom of, 486-487
- Prices, control of, in World War, 348; under NRA, 545-547
- Primary, direct, 67
- Printing, government, 373
- Prisons, 201-202; industries in, 362-363
- Prohibition, 500
- Propaganda, in election campaigns, 86-90; during World War, 346
- Prudent investment, as rate base, 432
- Public finance, *see* Finance
- Public health, *see* Health, public
- Public ownership, *see* Business
- Public utilities, government-owned, 300-302, 304-305, 361-362; importance of private, 419; why regulated, 419-420; scope of term, 420-422; service regulation, 422-428; rate regulation, 428-436; holding companies, 436-438; utility regulating bodies, 438-440; commission procedure, 440-443; expert and regulation of, 443-444; public ownership, 444; overhead wiring controlled, 514-515; and growth of monopolies, 523
- Public works, 6-7, 271-276, 530, 531-532
- Puerto Rico, government of, 22
- Purchasing, of supplies, 268-271
- Quarantines, for immigrants, 465-466; domestic, 467
- Quorum, 134-135
- Radio, use of in diplomacy, 28; international treaty regulating, 28-29; imperfections of radio acts, 101-102; laws, 112-113; treaty governing, 131-132; imperfect law regarding, 139; government control in World War, 351; government radio system, 368-369; censorship of, 489-491
- Railroads, subsidies to, 1; government-owned, 5; Crédit Mobilier scandal, 153; land grants to, 281; government-owned, 363; control of, during World War, 349; as utilities, 421; abandonment of lines, 424-425; consolidation, 426; fair rate of return, 429-430; valuation for rate purposes, 431-433; safety rules for, 477; and city plan, 513
- Rates, regulation of public utility, related to service, 422-423; discrimination in, 428-429; fair return, 429-430; efficiency and, 430-431; bases, 431-433; revision of, 433; control over security is-

- sues and, 433-435; courts and, 441
- Recall, of public officers, 68-69, 239
- Recapture, in utility regulation, 424
- Recovery program, *see* Economic planning
- Referendum, 69-72, 74-76; Erie Canal, 85-86; aqueduct, 87-88; and charters, 129
- Regions, problems of, 43-51; planning for, 517-518
- Registration, of voters, 77-78
- Reorganization, of administration, 9-10, 227-233
- Reports, public, 417-418
- Reproduction cost, as rate base, 431-433
- Research, government, 414-418
- Reserves, for war, types of, 338-339; efficiency of, 339-340; of supplies, 340
- Retaliation, in foreign affairs, 34
- Retirement, compulsory, 241, 246-247
- Revenues, government, taxation, 291-300; from business, 300-302; intergovernmental grants, 302-303; excess condemnation, 303; gifts, 303; fines, 303-304; public debt and, 304-309; for war purposes, 352
- Rubbish, disposal of, 402
- Rules, uniform state, 42; making of, 100-103; nature of, 111-112; influence of statutes on, 117-118; making of, 156-162
- Safety, accident toll, 473; building codes, 473-475; factory hazards, 475-476; safety on the seas, 476-477; and railroads, 477; and motor vehicles, 478-479; aviation, 479-480
- Saint Lawrence Seaway, 371, 389
- Samoa, government of, 23
- Sanitation, Chicago problems, 35-36; and annexation, 47; in New York area, 142-143; sewage disposal, 399-401; state plans, 401-402; recovery aid to, 549
- Schools, public service, 246; opinion in, 491-492
- Securities, public utility, regulation of, 433-435
- Senate, *see* Congress
- Separation of powers, 96-109
- Service, public utility, related to rates, 422-423; construction and abandonment of, 423-425; duplication in, 425-426; standards for, 426-428
- Service-at-cost franchises, 433
- Sewage, *see* Sanitation
- Sheriff, 186-187
- Shipping, subsidies to, 2; aids to navigation, 2; rule-making for, 100, 102; tribunals for cases involving, 103-104, 104-105; rule-making for, 117-118; lobby, 148; rule-making, 159-160; subsidies to, 277-278, 282; loans to, 284-285; government control during World War, 349-351; government ownership of lines, 357, 361, 365; government harbors, 366; waterways for, 387-389; navigational aids, 390-391; iceberg patrol, 391; rescue of the shipwrecked, 406-407; quarantines, 467; fumigation, 467; safety rules for, 476-477
- Signs, control of street, in cities, 514
- Silver, as money, 315; bimetalism, 315-317
- Slums, *see* Housing
- Smoke, regulation of, 469
- Special assessments, 294-295
- Special districts, nature of, 20-21; formation of, 49-50, 51; flood control on Hudson River, 398-399
- Special sessions, 133-134
- Specifications, for supplies, 268-269; for public works, 272-273
- Spoils system, 235, 253
- Staffs, in administration, 219-220
- State, Department of, 27



- States, nature of, 21; interstate disputes, 35-37; compacts between, 37-39; financial aid to, 39-40; uniform state laws, 40-43; state's rights, 52-57; separation of powers in, 96; constitutions of, 111; legislatures of, 121, 132-156; administrative complexity of, 225-227; reorganizing administration, 227-233; control of local accounts by, 266-267; Federal financial aid to, 283-284, 302; utility regulation by, 439; register trademarks, 462; freedom of the press, 487; movie censorship, 487-489; and schools, 491-492; blue laws, 496-498; birth control laws, 499-500; planning of land utilization, 518-519; anti-trust laws of, 524-525; petroleum quotas, 539-541; housing, 548; new relations of Federal Government to, under NRA, 551
- Statistics, government, need for, 410-411; weather, 412-413; population, 413; works of man, 413-414
- Statutes, nature of, 111; effects of constitutions on, 113-117; influence on rule-making, 117-118; classification of statutes of Connecticut and of United States, 119-121; passage of, 123-128; rule-making as temporary substitute for, 162
- Stream-gauging, 412-413
- Street railways, government-owned, 363, 385-386; service-at-cost franchise, 433
- Streets, congestion in, 505; in city planning, 510-511; in subdivisions, 511-512; signs and wiring in, regulated, 514-515
- Subdivisions, real estate, regulation of, 511-512
- Subsidies, 1-2; nature of, 276-277; reasons for, 277-278; bonuses, 278-281; grants in kind, 281; excess payment for services, 282-283; intergovernmental grants, 283-284; loans, 284-287; arguments against, 287-288; rationality and, 290; to farmers, 541-543
- Suffrage, 77-81
- Sugar, bounties for, 278-279
- Summons, of witnesses before legislative and executive bodies, 143-144; court, 187
- Sunday blue laws, 496-498
- Super-power, government-owned nets, 371-372
- Supplies, government purchase of, 6, 268-271; government manufacture of, 271; rationality and buying of, 290; sale of war surplus, 353-354; government manufacture, 360-361, 362-363, 374-375
- Supreme Court, United States, 179-180, 191
- Tariffs, 293-294, 523
- Taxation, nature of, 291-292; purposes of, 292-294; tax bases, 294-296; tax powers of governments, 296-297; influence on industry, 297-298, valuation, 298-300; revenue from government businesses for tax relief, 301-302; during World War, 352; destroys poison match trade, 469; processing tax on agriculture, 537
- Technocracy, 533
- Telegraph, Federal aid to Morse, 279-280; government control in World War, 351; as a public utility, 421
- Telephone, government control in World War, 351; government ownership of minor systems, 369; as a public utility, 421; consolidation of companies, 425
- Television, censorship of, 490-491
- Tennessee Valley Authority, 357, 371

- Testing, of supplies, 269-270  
Town, nature of, 20  
Townships, 20  
Trade-marks, 462  
Treaties, 28-31; contrasted with agreements, 32; difficulty of revision, 131-132  
Trucks, varied state laws on, 40-41  
Trusts, 4; and patent monopolies, 453-456; *laissez faire* and, 522; growth of, 523-524; anti-trust laws, 524-527  
Tunnels, government toll, 363-364  
Unemployment, technological, 14-15, 527-528; relief for unemployed, 531-532; shorter hours and, 543; subsistence farms, 550  
Unions, of government employees, 242-243  
Unitary plan of government, in France, 58-59  
Universal Postal Union, 33  
Vaccination, 464-465  
Valuation, for tax purposes, 298-300; for utility rate-making purposes, 431-433, 442  
Veterans, pensions for, 342; bonus, 342-343; institutional care of, 343  
Veto, 97, 125-127, 128  
Village, as unit of government, 20  
Virgin Islands, 22  
Vocational restrictions, 492-496  
Voting machines, 80-81  
Wages, minimum, 544-545  
War, American experience, 320-321; technology and, 321-322; praise of, 322-323; destructiveness of, 323-324; peace movement, 324-326; arms trade, 326-328; profits in, 328-329; mobilizing for, 343-344; industrial problems of, 344-349; transportation and, 349-351; communication and, 351-352; financing, 352; return to peace footing, 352-354; future of, 354-355  
Washington, D. C., 21  
Washington Conference, naval limitations at, 330-332  
Water works, government operation, 5; interstate disputes over, 36; extra-territorial rights and, 45-46; annexation and, 47, 48; referenda on, 71, 72; government operation, 369-370, 385; as public utilities, 421-422  
Waterways, 2; Federal barge line, 361, 365; improvement of, 387-389  
Weather, study of aviation, 394; general, 412-413  
Witnesses, 185, 188-189  
Workmen's compensation, court trials, 480; new laws, 480-482  
World War, destructiveness of, 324; American operations in, 344-354  
Zoning, 506-510













